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THE MOTOR ROUTE FROM PEKING TO KASHGAR: *A paper read at the Evening Meeting of the Society on 16 November 1936, by*

SIR ERIC TEICHMAN, K.C.M.G., C.I.E.

IN the autumn of 1935, when Sinkiang was settling down after the convulsions of the Mohammedan rebellion, I was sent on a special mission to establish contact, on behalf of the British Embassy in China, with the new Provincial Government in Chinese Turkestan. On investigating ways and means of making the journey, I decided, following the example of Dr. Sven Hedin and other pioneers of mechanical transport in Chinese Central Asia, to try out the possibilities of crossing the Gobi and traversing Sinkiang by motor truck. When I started to organize my expedition I found it difficult to obtain reliable information about the route and the feasibility or otherwise of motoring through to Kashgar; and the following description of the motor route, such as it was in 1935, from Peking to Kashgar may, it is hoped, prove of assistance to future travellers contemplating the same journey.

Motor transport has revolutionized travel in Mongolia and Chinese Turkestan, and one can nowadays accomplish in a few weeks the long journeys which formerly occupied many weary months of travel by camel caravan or cart. Motor cars and trucks first made their appearance in Chinese Central Asia after the war on the grassy steppes of Mongolia, which are specially suited to motor traffic, and as long ago as 1920 I travelled in one of Mr. Larson's Dodge cars from Kalgan to Urga. It was not however until many years later that motor traffic was developed in the more sandy wastes of the Western Gobi and Chinese Turkestan.

The overland traveller from China to Central Asia has the choice of two routes, the old Imperial cart road through Shensi and Kansu, and the camel trails through Inner Mongolia. While it is possible to get trucks through by the old cart road, the Mongolian route, by which I travelled, is the one better suited for motor traffic. There used formerly to be a third route, which was in fact the road generally followed by the Central Asian caravan trade, the camel trail from Kwei-hwa-ch'eng (Sui-yuan) through Outer Mongolia to Ku-ch'eng and Urumchi. This route, which was the one followed by early European travellers (including Captain Younghusband in the 'eighties), has

had to be abandoned owing to the closure of the Outer Mongolian frontier, and Chinese caravans taking the Gobi route have since followed the camel trails through Inner Mongolia *via* Shan-tan Miao and the Etsin Gol to Ming Shui and thence *via* Hami or Ku-ch'eng to Urumchi. This is the route, "The Winding Road," described by Mr. Lattimore in his book 'The Desert Road to Turkestan.' As it traverses the Gobi longitudinally for 1000 miles or so, it is a more barren and arduous road than that through Outer Mongolia, which, running most of the way across grassy steppe lands to the north of the Gobi Desert would, if available, afford better going for motor traffic between China and Turkestan.

Various attempts were made, after the closure of Outer Mongolia, to find a feasible motor trail from China to Sinkiang by the Inner Mongolian route. The difficulty lay in how to cross the wastes of sand, stretching across Inner Mongolia from Kansu and the Alashan desert to the Outer Mongolian border, which render the main camel trail *via* Shan-tan Miao impassable for motor traffic. A practical motor route across the Inner Mongolian Gobi was eventually discovered about five years ago by the Söderbom brothers (the sons of a Swedish missionary from Kalgan on the Mongolian border) and their Mongol guide Serat, who solved the problem of getting round the sands by working out a new route between Uni-Ussu and the Etsin Gol, an adaptation of minor camel trails and detours across the desert, along and close to the Outer Mongolian border.

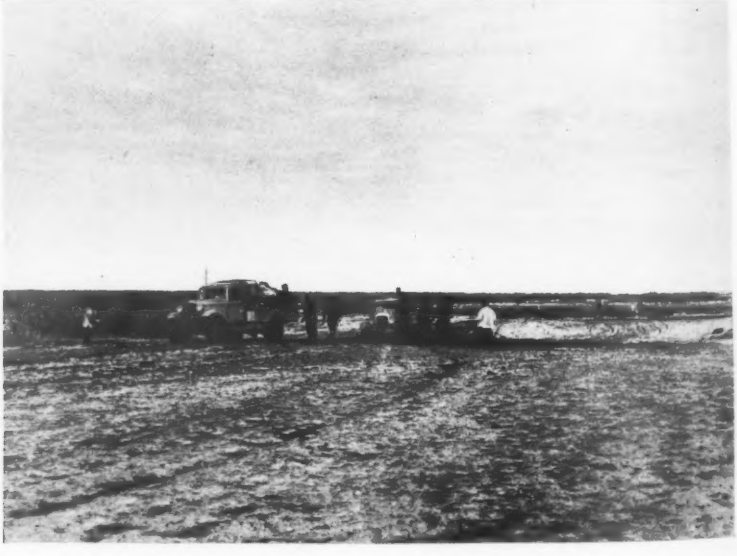
The new motor route across the Inner Mongolian Gobi, first traversed by the Söderboms and Serat in 1930–31, has since been followed by the Hardt-Citroën Expedition, by a party of China Inland missionaries proceeding to Urumchi, by Dr. Sven Hedin on his last expedition in 1934, and by the trucks of an American firm in Tientsin bringing down cargoes of produce from Sinkiang; and it is now used by the Sinkiang–Sui-yuan (*Sin-Sui*) motor transportation company, a Chinese concern which runs trucks between Sui-yuan and Hami at irregular intervals. Owing to political difficulties the trucks of this enterprising company are not allowed at present to go beyond Hami. While the credit for the original exploration of the route lies with Serat and the Söderboms, present-day travellers along it have reason to be grateful to the *Sin-Sui* company, who have discovered new detours and done a certain amount of work on the road and improved some of the worst places.

Although the new motor trail through Inner Mongolia is now frequently used by these Chinese trucks, every journey is an adventure and for much of the way a long struggle against the sand. Ten miles per hour is a satisfactory average in the Gobi, say 80 to 100 miles per day, if nothing untoward occurs. On the other hand, if things go wrong and one sticks badly in heavy ground, the whole day may be spent in covering a few miles. Nothing is obtainable on the 1200-mile journey across the desert from Sui-yuan to Hami, and it is necessary to carry a liberal supply of spare parts, as well as all kinds of implements and apparatus for extricating the trucks from sand and mud, including spades, picks, wooden planks, rope mats, towing hawsers and special jacks. (When a truck is completely stuck in sand or mud the rear wheels have to be dug out and jacked up and planks and rope mats inserted underneath.) Sufficient petrol must be carried or sent on ahead to depots in the desert to

Loading up at Pai-ling Miao. Monastery in the background

The eastern Gobi. Bandin Tologoi

Wayen Torrai. Chinese Government wireless station



The Dzungarian steppe, approaching Urumchi

enable one to cover the 1200 miles to Hami, where the first supplies of Russian petrol are obtainable, but at present only through official sources. Estimates of the amount of petrol required should be based on a minimum average of 4 to 5 miles per gallon for a loaded truck in the desert, allowing for the necessary low-gear work in sand and bad ground.

The motor vehicles at present in use on the Sui-yuan to Hami run across the Gobi are mostly Ford V8 3-ton trucks, which have proved themselves to be strong, fast, powerful, and reliable, and have the advantage of being familiar to the Chinese and Mongols who drive the route. Only the strongest machines will stand the strain of Gobi travel—and the nature of some of the ground that has to be crossed must be seen to be believed. The Citroën tractors of the Hardt expedition were, according to Mongol reports of their work which I heard, good in sand but bad on rocky ground and too slow for the purposes required. In Chinese Turkestan, *i.e.* from Hami to Urumchi and from Urumchi to Kashgar and the Soviet frontier, only Russian *Amo* trucks are in use, motor transportation being monopolized by the local Government, who have acquired a large fleet of these *Amo* trucks from the U.S.S.R. They are strong and carry heavy loads, but seem underpowered as compared with the Ford V8 trucks for the nature of the work they have to perform.

The necessary native equipment and supplies for crossing the Gobi can best be obtained in Kwei-hwa-ch'eng (Sui-yuan), including Mongol tents, which, felt-lined for the winter, are more suitable for this kind of travel than any other type of foreign or native tent. The Sui-yuan sheep-skins are amongst the best in Asia, and we were grateful when crossing the Pamir in the depths of the winter for our Mongolian sheepskin sleeping-bags and robes, which were superior to anything of the kind obtainable at Kashgar or on the Indian frontier. All food supplies, except meat, must be carried sufficient to reach Hami. Sheep can be purchased *en route*, and antelope, sand-grouse, duck, and an occasional bustard, can be shot in the desert.

Wells are met with every 20 to 30 miles along the camel trails, but it is not easy to find them without a competent guide who knows the road.

Fuel is obtainable in most parts of the desert, in the form of dead tamarisk and poplar wood, which burns very well, better than the *argols* (dried cattle dung) of the steppe country. Apart from fuel and water there is nothing at most of the halts but the bare well, unless one happens on the *yurts* of a depot of the *Sin-Sui* Company or of a Chinese trading post.

Where possible it is best to follow the old camel trails, which are firmer and better going than the rest of the desert. Over long stretches of the Gobi the surface is gravel over sand, and once off the camel trails the heavy trucks break through the top surface and have to plough for hour after hour through the sand on low gear. The worst part of the road from Sui-yuan to Hami, for sand and heavy going, is the first half, to the Etsin Gol. Thereafter the going, though rocky and stony in places, is better. Some of the worst going is across the sandy beds of dry rivers, and some of the best on the smooth firm surface of dry lake bottoms. The latter sometimes furnish a virgin motor road as smooth as tarmac along which one can travel at high speed for miles on end.

The different seasons of the year all have their disadvantages for crossing the Gobi by motor: in winter the extreme cold, in the spring the wind and

sand storms, in summer the heat of the sun, and in the autumn, in Inner Mongolia, the rain, which may make the softer parts of the desert impassable for a time. Probably the early winter months, November and December, are the best in spite of the cold; or the early summer, May and June.

In Sinkiang, from Hami to Urumchi and Urumchi to Kashgar, the motor route follows for most of the way the old cart road, which affords on the whole easier going than the camel trails of the Gobi. The carts of Turkestan have a specially broad gauge, which facilitates motor traffic, since motor trucks can generally pass wherever the carts go; whereas in North China a cart track will always sooner or later become too narrow for a motor vehicle. The Sinkiang roads are however often very bad in the oasis country, owing to the many streams and irrigation channels that have to be crossed.

The late autumn, or early winter, is probably the best season for traversing Chinese Turkestan by motor, and the spring thaw time the worst. In the summer also the rivers and streams and irrigated ground are troublesome. In mid-winter the country north of the T'ien Shan is snow-bound and too cold for motor travel.

Serais, or house accommodation of some kind, are everywhere available in Sinkiang, and from Hami on it is unnecessary to carry tents or large supplies of food.

It took me thirty-eight travelling days to cover the 2550 miles by motor truck from Sui-yuan to Kashgar, but I encountered various mishaps on the earlier part of the journey. With proper organization and preparation it should be possible to do the journey by motor truck in a month, as compared with four to six months by camel caravan or cart.

My transport consisted of two Ford trucks, one new and one old, the latter having already done some thousands of miles of expedition work with Dr. Sven Hedin the year before. The old truck suffered several mechanical breakdowns and had eventually to be abandoned 500 miles short of Kashgar; the new one reached the end of the journey in perfect condition, and had the distinction of being the first motor vehicle to be driven through from the Chinese border to Kashgar. The moral is that only new machinery is good enough to stand up to the strain of Gobi travel. My native staff of six included two Mongol driver mechanics who had been with Dr. Hedin on his last journey. One of these was the Mongol Serat, whose invaluable services I obtained through Mr. George Söderbom of Kwei-hwa-ch'eng. Serat was my right-hand man throughout the journey. Starting as a youth in the service of Mr. Larson, he had spent his life wandering across the length and breadth of Inner and Outer Mongolia. Subsequently he made two expeditions with Dr. Hedin to Sinkiang, and he can now probably claim to know more than any one else about the routes and practical details of motor travel in Mongolia and Chinese Turkestan. The adventures of Serat and the other members of the Sven Hedin Expedition of 1934–35 are graphically described in Dr. Hedin's recently published book, 'Big Horse's Flight.'

We started in the latter part of September from Sui-yuan (Kwei-hwa-ch'eng), which from time immemorial has served as the terminus on the Chinese border of the Central Asian caravan trade. Sui-yuan can be reached by the Peking–Sui-yuan railway in twenty-four hours or so from Peking, thus avoiding the

Soft ground in the desert near Hoyer Amatu

Good going across the T'ien Shan

Working on the road in the Toksun gorge

Entra

difficult Nankou pass and 300 to 400 miles of rough going along the Inner Mongolian border. Starting the motor journey from Sui-yuan, one ascends by a stony cart track through the mountains leading up to the grasslands of the Mongolian plateau. Once on the steppes the going improves and a day's run across grassy prairies brings one to Pai-ling Miao (Mongol Batur Halak), one of the biggest monasteries in Mongolia. In 1935 a village of *yurts* alongside the monastery housed the newly established Government of Autonomous Inner Mongolia.

From Pai-ling Miao the trail continues across the Mongolian steppe for 160 miles to Uni-Ussu ("Cow Water"). The going is good on this stretch, except for some miles of heavy sand in the Yang-ch'ang-tzu Kou ("Sheep Gut Valley"). At Uni-Ussu begins the crossing of the Gobi, which, except for the Etsin Gol country half-way, extends for near 1000 miles to Hami, the first big oasis in Chinese Turkestan. It is therefore also at Uni-Ussu that the difficulties of desert travel really begin. The main camel trail here turns south to Shan-tan Miao, while the new motor track continues west along the Outer Mongolian border. Some 70 miles west of Uni-Ussu, near the well of Bayen Unter, the track is crossed by a line of sandhills impassable to motor traffic stretching across one's front into Outer Mongolia. These sands can be detoured either by making a dash to the north through the forbidden land of Outer Mongolia (this has been done but is *not* recommended), or by turning south and following along the dry bed of the Meringen Gol.

Beyond Bayen Unter the motor track continues west-north-west across a gravel Gobi plateau. This is probably good going in dry weather, but we were unfortunate enough to be travelling across it during the autumn rains, which made the surface of the desert too soft to bear the weight of the trucks. Rain and waterlogged ground are not the kind of trouble one expects to meet with in the Gobi; but in this neighbourhood towards the end of September it rained continuously for nearly twenty-four hours, and, after a day's delay in camp waiting for the desert to dry, we spent nearly twelve hours in covering 20 odd miles. All the time the twin peaks marking the well of Hoyer Amatu were in sight, but it seemed as though we should never reach them, when finally, as night was falling, one of the trucks sank up to its back axle in the bed of a sandy stream. Again we had to camp where we had stuck, and it was not until the next day, after struggling across some higher ground and picking our way laboriously through rocks and sandhills, that we reached Hoyer Amatu, a well and the *yurts* of a Chinese trading post lying in an immense plain bounded on the north by a range of low mountains on the Outer Mongolian border, here about 10 to 15 miles off.

For the next 100 miles, from Hoyer Amatu to Bandin Tologoi, we continued to have trouble with sand and soft ground. Twenty-five miles out we passed Abter well, where we were obliged to leave the camel trail we had been following on account of the sand and turn north towards the Outer Mongolian border. After various adventures and misfortunes, including a serious mechanical breakdown involving a further delay of twenty-four hours, we reached and camped near some lagoons 50 miles from Hoyer Amatu and a few miles north of the well of Yingen, which we had failed to find. Yingen well lies at the meeting point of the borders of Outer Mongolia, Sui-yuan, and

Entrance to the Toksun gorge

Ning-hsia, and, so far as I could make out, we were here actually camped in Outer Mongolian territory.

The next day we covered the remaining 50 miles to Bandin Tologoi, where there is quite a settlement of *yurts* belonging to local Mongols and Chinese traders. Here our route crossed a camel trail from Urga to Kansu, which in 1927 was one of the main lines of communication between the Chinese revolutionary forces and the U.S.S.R.

This region of the Gobi consists of immense plains of gravelly sand sparsely dotted with tamarisk bushes, all tinder dry and invaluable for fuel, and interspersed with the flat sandy beds of dry rivers, which are usually troublesome to cross. Most of the way the view to the north is bounded by a low range of mountains marking the Outer Mongolian border and the northern edge of the Gobi desert. From what I heard the camel trails to the north of these hills in Outer Mongolia should lie across grassy steppe country and afford much better going for motor traffic bound from China to Turkestan. Unfortunately the local political situation prevents their being used.

My map of the motor route across the Gobi is decorated with numerous place-names, but most of these are only bare wells, which it would be impossible to find without a guide who knows their whereabouts.

Beyond Bandin Tologoi, in spite of many bad patches of sand, we found the going better, with some long smooth stretches of firm gravel where we travelled at a good pace. The trail, after crossing a broad sandy depression, runs through range after range of low Gobi hills, often grotesquely shaped and coloured red, yellow, green, and blue. Finally one emerges from the last range of hills to reach, 150 odd miles from Bandin Tologoi, the poplar belt marking the eastern edge of the oasis of the Etsin Gol. Coming from the east trees and pasture are first reached at the well of Wayen Torrai, where the Chinese Government have recently established a small wireless station in a Mongol *yurt*.

The Etsin Gol is known higher up to the Chinese as the Hwei Ho (Black River), where it issues from the mountains of the Kokonor and waters the oases of Western Kansu before flowing north into the desert. Beyond the township of Mao-mu it splits up into two or three main and other subsidiary channels and flows north for 200 miles or so to end in the twin salt lakes of Gashun Nor and Sogo Nor on the border of Outer Mongolia. This is the Etsin Gol oasis, a long narrow strip from 30 to 50 miles across, a region of desert poplars, tamarisks and thin reedy grass, inhabited by a tribe of Torgut Mongols and surrounded by the desolation of the Gobi. In the summer most of the river water is used by the farmers in Kansu for irrigation purposes and in the winter the streams are frozen. In both these conditions it is possible, if one knows the way through the sandhills, to drive motor trucks across the various channels of the river. At the time we made our journey, in the autumn months however, motor traffic had to make the long detour round the twin lakes to the north. This involves an extra 100 miles as compared with the direct route. It is a hard run through heavy sand and a terribly desolate region round the two salt lakes and along the base of the range marking the Outer Mongolian border. Then one strikes another camel trail running south from Urga to Kansu and Tibet, which affords good going for the rest of the way south to

Ulan-chonchi, a remote little tax station on the western edge of the Etsin Gol oasis.

From Ulan-chonchi it is a run of 300 miles across the Black Gobi to the Sinkiang border. The going is rocky and mountainous much of the way, but there is less heavy sand than on the stretch east of the Etsin Gol. This region of the Western Gobi gives an impression of extreme emptiness and desolation. It is practically uninhabited, and over considerable stretches there is no scrap of vegetation, even the desert shrubs and tamarisks giving out. There are *yurts* of Chinese traders at only two points, Shih-pan Ching and Kung Po Ch'uan. From Ulan-chonchi to Shih-pan Ching we found the going fairly good, at first across a vast plain and then through low Gobi hills. Over a distance of 90 miles on this stretch there are no wells, involving great hardship for the camel caravans but, given ordinary precautions, none for the traveller by motor truck. For, though we were on occasion forced by misadventure to camp where there were no wells, we always carried an ample supply of water in empty petrol drums.

Beyond Shih-pan Ching there is some rather difficult ground through a range of mountains near the top of which lies Yeh Ma Ching-tzu ("The Well of the Wild Horse"). This well lies just off the route, being inaccessible to motor traffic owing to the narrow pass.

About 200 miles from the Etsin Gol we reached Kung Po Ch'uan. The neighbourhood is marked by the ruins of a fortress on a nearby hill-top, an unusual sight in this empty land. These are the ruins of the stronghold of the outlaw lama chief, a Russian Mongol, who established himself in this remote region in the early nineteen-twenties, when Mongolia was in a state of turmoil. For some years he levied tribute on the passing caravans and surrounding countryside, until he was eventually killed and his followers dispersed by an expedition sent by the Outer Mongol and Russian authorities. Versions of this singular story, which is still told and re-told round the camp fires of the Gobi caravans as they pass the neighbourhood, will be found in the books of Mr. Lattimore and Mr. Haslund.

The Western Gobi is a jumble of mountains, and it is not easy to distinguish the continuity of the different ranges. One of the more distinctive features is the Ma Tsung Shan range, which runs much of the way along the southern horizon on the left hand as one travels west. Beyond these mountains lies the old Kansu cart road across the Gobi.

From Kung Po Ch'uan, where one first meets with sweet water springs (*Ch'uan-tzu*) in place of the often bitter Gobi wells (*Ching-tzu*), the trail ascends through the mountains to the Sinkiang border. This is a remote and desolate region, utterly empty save for the wild ass and antelope. The Sinkiang border is reached at Ming Shui ("Clear Water"), which figures prominently on the map but comprises actually only a ruined hut and well in uninhabited desert mountains. Near by are some ruined forts and towers of great antiquity marking the Mongolian–Turkestan frontier.

The Ming Shui pass (6700 feet) marks the highest point on the Gobi crossing, and one descends across an immense slope of hard gravel, good going for the trucks, into the desert plains of Chinese Turkestan. To one's front rises the eastern end of the T'ien Shan, the snow-capped Karlik Tagh,

a fine view which impresses itself all the more on the memory because it marks the end of the weary Gobi crossing. Rounding the southern base of the Karlik Tagh and passing the outlying oasis of Miao-erh-Ku, where Turki peasants are first met with, we reached Hami, the eastern gateway to Sinkiang. Here the traveller finds himself in a new country, China and Mongolia are left behind, and the people, language, scenery and buildings are those of Eastern Turkestan.

Hami lies close under the southern face of the T'ien Shan, and the road to Urumchi (368 miles) runs north-west and crosses the main range by the Ta-shih-t'ou gap between the Karlik Tagh and the Bogdo Ula peaks. The pass, 5300 feet, is relatively easy for motor traffic and the going is good most of the way on the long descent across the plains of Dzungaria on the other side. We were now in Northern Sinkiang, known to the Chinese as *T'ien Shan Pei Lu* ("the Circuit North of the T'ien Shan"), a cold bleak land resembling Mongolia and Siberia rather than Turkestan. The first large city to be reached is Ku-ch'eng, a Chinese trading centre and the terminus of the camel caravan route from China. From Ku-ch'eng to Urumchi, 126 miles, the road is generally bad, as one passes through a series of agricultural oases watered by streams and irrigation channels from the T'ien Shan. The countryside is full of game, especially partridges and hares. All the way the snow peaks of Bogdo Ula are in full view, as one circles round them to reach Urumchi.

This road which we followed from Hami is the summer motor route to the Provincial Capital. In the winter, from November on, it is snow-bound and motor traffic follows the road *via* Turfan south of the T'ien Shan.

Urumchi, known to the Chinese as Ti-hwa, is too well known to call for much description. It is the capital and administrative centre of Sinkiang and comprises three towns adjoining one another, the Chinese city (seat of the Provincial Government), the Moslem city (Turki and Tartar bazaars), and the Russian quarter. It lies close under the T'ien Shan, on their northern face, in a basin-like break in the main range, backed by the snows of Bogdo Ula and nearly surrounded by hills, with an opening to the north, where the Urumchi river flows out on to the steppes of Dzungaria to end in a vast marsh farther north. The climate is severe, resembling that of Harbin in Manchuria. Before we left, in the middle of November, the countryside was already under snow and the thermometer had fallen to zero Fahrenheit at night time. There is not much to be said for Urumchi as a place of residence, but it is a centre of the first importance in Central Asian politics and history.

From Urumchi to Kashgar, about 950 miles, the motor route follows the old cart road. We travelled *via* Turfan, involving a detour of 25 miles, in order to visit this important and interesting oasis, famous for its situation some hundreds of feet below sea-level, its archaeological remains, its seedless raisins and other fruits, and its terrific summer heat. In mid-November however the climate was pleasant enough, with some degrees of frost at night. The road from Urumchi across the Ta-pan pass in the T'ien Shan presents no special difficulties for motor traffic and we were glad to be back in the relative warmth of the country south of the T'ien Shan.

The main south road (*T'ien Shan Nan Lu*) is rejoined at Toksun, an oasis similar to, but smaller than, Turfan. A few miles farther on one has to pass

through the famous, or rather infamous, Toksun Gorge, the most difficult and dangerous place for motor traffic between Peking and Kashgar. Nor can these gorges be avoided, as this route, the old Imperial cart road, is the only possible one for motor traffic between the north and the south of Chinese Turkestan. The road traverses a mountain range by a narrow gorge and in two places ascends very steeply over a sort of rock avalanche and between huge boulders. This place has been the grave of many motor vehicles, and we lost one of our trucks on it. It is to be hoped, for the sake of future travellers, that the Provincial Government will turn their attention to blasting a proper passage through the rocks. The present condition of the road through the Toksun Gorge is evidently much the same as it was fifty years ago, since the description given by Captain Younghusband in 'The Heart of a Continent' might have been written to-day.

After our adventures in the Toksun mountains we spent the night in the miserable hamlet of Kumush on the farther side of the pass, where we had to abandon one of our trucks which had broken its differential gear on the ascent over the rocks in the gorge. We twice had to take down the back axle of a truck in the desert, but on this occasion had no spare part to replace the damaged gear. On the following day we covered the remaining 100 miles of relatively good going to Karashar, where one is again in a Mongolian atmosphere, as this is the centre of the Torgut Mongols of Sinkiang, who occupy the pastures of the neighbouring T'ien Shan ranges. Here we encountered the second major obstacle of the Urumchi–Kashgar road, the crossing of the Karashar river flowing down from the mountains into the Bagrach Kol near by. In the summer the Karashar river can be crossed by a ferry boat taking camels, carts and motor trucks, and in mid-winter it is frozen and motor traffic can cross on the ice. We were unfortunate enough to arrive just at the moment when the ice had started to pack, so that the ferry boat was frozen in, and, though foot traffic was already crossing on the frozen surface, it was not expected that the ice would be strong enough to bear the weight of the motor trucks for another two or three weeks. Eventually, with the assistance of a party of Russians, who were interested in getting their trucks across from the other side, we succeeded after two days' work in breaking a passage for the ferry boat through the ice and effecting a difficult and rather dangerous crossing.

From Karashar to Kashgar, 684 miles, we met with no further serious difficulties, though the road is bad and sandy in places and there is one big river, at Aksu, to be crossed on the way. We crossed the Aksu river by a very inadequate bridge built for the cart traffic, but a ferry near by affords an alternative and probably safer method of crossing. The road passes through the chief towns and oases of Southern Sinkiang, such as Korla, Kuchar, Aksu, and Maralbashi, which go to make up the *Nan Lu* ("South Road" or "Southern Circuit") and constitute the heart of Chinese Turkestan. The cities, packed on bazaar days with peasants from the surrounding oases, are purely Turki in appearance; and a Chinese face is nowadays as rare amongst these Turkish crowds as that of a foreigner in the interior of China. For long stretches on both sides of Maralbashi the sand is very bad, involving many hours of low-gear work and frequent recourse to the spade. This neighbourhood is the

edge of the great central desert of Chinese Turkestan where the atmosphere is usually shrouded in dust haze. A thin white dust lies ankle and knee deep on the track which winds through ghostly forests of dead poplars and tamarisks. This white dust is not however a serious impediment to motor traffic, and it is only when one reaches stretches of real sand that the trouble begins.

We had left Urumchi on November 14, but, owing to the delay of some days at Karashar, we did not reach Kashgar until November 29. The latter part of the journey was a race against time, as every day's delay increased the difficulties of the winter journey across the Pamir and Karakoram to India. I was eventually able to leave Kashgar on December 9 and reached Gilgit a month later. This stage of the journey, 400 odd miles across the mountain barrier separating the upper waters of the Indus from the plains of Turkestan, can of course only be done by pack animal, the farthest point possible for motor traffic being the foot of the hills 30 miles or so from Kashgar. The snow on the Mintaka Pass (15,450 feet) on the frontier was rather deep, but we crossed without incident after transferring our loads from our own ponies to some yak furnished by the local Kirghiz. On the whole the winter journey across the Pamir and Karakoram presented no special difficulty, apart from the cold. At one of our camps on the Pamir we recorded more than 20° below zero Fahrenheit at night time. The cold makes itself felt all the more owing to the constant high winds and scanty supply of fuel, *argols* and brushwood, available on the Pamir. It is a relief to cross the pass and reach the comfort of the Mir of Hunza's rest-houses and their abundant supply of firewood. On the other hand the winter route *via* the Ghez defile from Kashgar to the frontier affords wonderful views of the Kungur and Muztagh Ata ranges, both over 24,000 feet high, towering over the Chinese Pamir.

Arriving in Gilgit early in January we found, as was to be expected, that it was impossible to get through to Srinagar owing to the snow on the Burzil Pass. My Chinese and Mongol staff were sent out through Chitral, but I myself was saved this further long tramp through the snow by the courtesy of the Government of India, who fetched me down from Gilgit by air. This was, I believe, the first time that an aeroplane had visited Gilgit during the winter, and on the first attempt the machine, an Avro X, piloted by Flight-Lieut. Jackson, flew into bad weather and had to turn back to Rawalpindi owing to ice forming on the wings. The second attempt, made the next day, was successful; and on the following day, January 16, we flew from Gilgit to Delhi in perfect weather. We crossed the Himalaya at 15,500 feet, following most of the way down the gorges of the Indus with wonderful views over Rakaposhi, Haramosh, Nanga Parbat, and the peaks and valleys of Kohistan. The flight from Gilgit to Rawalpindi took under two and a half hours, as compared with the fourteen days or so occupied by the same journey by road.

Note on the map

The map is based on a compass traverse by the author. The eastern portion is adjusted to the position of Sui-yuan (Kwei-hwa-ch'eng) on the War Office map of Mongolia (G.S.G.S. No. 2957. Scale 1/4M) and to Sir Aurel Stein's position of Gashun Nor (Serial No. 44 of "Chinese Turkistan and Kansu"

Ferrying through the ice on the Karashar river

Village of Kuchar

Looks
lake

from surveys made in 1900–1, 1906–8, 1913–15. Scale 1:500,000). From Gashun Nor to the Mintaka Pass the traverse is adjusted to Sir Aurel Stein's observations and the position of Ti-hwa (Urumchi) has been taken from the War Office map (G.S.G.S. No. 2957. Scale 1/4M) in order to join the traverse between Ku-ch'eng and Turfan. The revision of certain observations in the neighbourhood of Korla noted in the "Memoir on maps of Chinese Turkistan and Kansu" (Trigonometrical Survey Office, Dehra Dun, 1923) has been used. Surrounding detail has been filled in from the War Office 1/4M maps and use has been made of the 1/2M map of Kashmir in the Southern Asia Series of the Survey of India, and of a sketch-map of the Lop Nor in 'Across the Gobi Desert,' by Sven Hedin.

The spelling of names is that preferred by the author and is not always in accordance with the decisions of the P.C.G.N.—ED. *G.J.*

DISCUSSION

Before the paper the PRESIDENT (Professor HENRY BALFOUR) said: We are fortunate in having persuaded Sir Eric Teichman to come and talk to us to-night about the motor route between Peking and Kashgar. It is a matter of something over 2500 miles. I am sure you are anxious to hear what he has to say rather than any remarks of mine, and so I will without further preamble ask Sir Eric Teichman to be good enough to give us his lecture.

Sir Eric Teichman then read the paper printed above, and a discussion followed.

The PRESIDENT: I understand that Mr. Peter Fleming is in the hall, and I will ask him to be kind enough to come and speak to us on a country which he also knows well.

Mr. PETER FLEMING: It strikes me that Sir Eric Teichman has made too little of a song and dance about a very considerable journey. He took it all —in his lecture as no doubt on the road—so very much in his stride that I think somebody ought to underline the very great powers of endurance which are needed to cross the Karakoram in December and January on ponies, and the equally great powers of patience and diplomacy which are needed to overcome the various obstacles and delays which you meet with on the motor road. A lorry, I am sure, is infinitely more unsatisfactory than pack animals, and I should say that the psychological strain, the perpetual anxiety and suspense, imposed on the traveller is very much greater than the far rarer annoyances sustained by other travellers who, because they cannot, do not rely on internal combustion. Apart from that, I do not think I have anything to add to an exceedingly interesting lecture, which modestly recorded a feat of which men half Sir Eric's age would have good reason to be proud.

The PRESIDENT: I do not think Sir Francis Younghusband is in the hall, and I am sorry to say that Mr. Lattimore is not with us. We were expecting him but, very unluckily, he has been prevented at the last moment.

I would like to say what a pleasure it has been to all of us to hear this account of what really was quite an adventurous journey. Sir Eric Teichman has been attached to the British Embassy in China for a great many years, and it is perfectly clear that he has made the most of his opportunities. He has travelled very widely indeed, both in North-Eastern China and Tibet, and, as you have seen to-night, right across from east to west, linking up the two extremes of the huge area which is administered by China.

It has been obvious, I think, that what Sir Eric was dealing with, in the main, is a route and not a road. His pictures brought home to us very admirably that

Looking across the Little Kara Kol lake towards the Kungur range

those who explore the routes in order to find the lines of least resistance between extremes are pioneers, and as a result of their work we see permanent roads which eventually play so great a part in the prosperity of a country. Sir Eric Teichman is to be congratulated on having done some of this work, and at any rate ascertained a possible route which does link the far extremes of Kashgar and Eastern China together. When that route develops into a made road, as undoubtedly it will with the increase of motor transport, one cannot help thinking that the administrative difficulties which confront China will begin to be very much lessened. It always seems that one of the great difficulties that China has had to contend with is means of transport and general locomotion within its vast area. Sir Eric and others who have explored the region are playing their part in bringing about what eventually will be a very great benefit to this apparently rather incoherent region.

I ask you to express your cordial thanks to Sir Eric for a most interesting lecture describing an adventurous journey, likely to lead to very important developments.

FROM THE BRAHMAPUTRA TO THE CHINDWIN: *A paper read at the Evening Meeting of the Society on 11 January 1937, by*

E. T. D. LAMBERT

ON 11 January 1926, exactly eleven years ago, the Naga Hills were last brought to the notice of this Society at a meeting by Mr. J. P. Mills, of the Indian Civil Service. In describing my journey from the Brahmaputra to the Chindwin, I am describing that part of the Naga Hills north and east of that dealt with in his paper, and I will attempt here without recapitulating too much of what Mr. Mills has said to give you some idea of the country which he was unable to visit and which it has been my good fortune to traverse.

Two series of major triangulation had been completed: In Assam up the Brahmaputra valley and in Burma up the Irrawaddy. The Geodetic Survey of India decided early last year to link these two series by a third, which would pass north-east from Assam through the Naga Hills, east across the Patkai, south-east to the Hukawng Valley and the Chindwin, and then south-west along the Irrawaddy–Chindwin watershed. Between these two great valleys of the Brahmaputra and the Chindwin lies a long range of jungle-clad mountains stretching from the Himalayas in the north to the port of Akyab on the Bay of Bengal in the south. It averages about 6000 feet in height and rises to its highest point, Saramati, at 12,200 feet. For much of its length it forms the boundary between Assam and Burma. It has not yet been completely explored, and contains some of the most primitive and warlike people in India. It has only been crossed on a very few occasions towards its northern extremity. The Naga Hills district is a long, narrow strip of this area which borders on the plains of Assam and was only taken over for administration to protect the people of the plains from the head-hunting raids of these primitive hill people. One other small area, that round the Tirap River, has also been taken over and is under the administration of the Political Officer of the Sadiya Frontier Tract. Administration in these backward tracts does not amount to as much as it does in the ordinary districts of India. The Indian Penal Code and other similar Indian laws are not in force, and the people are ruled as far as possible under their own laws and customs. They pay a small poll or house tax varying from Rs.2 to Rs.5, and in return for this Government provides an administrative officer, schools, and dispensaries. Head-hunting and human sacrifice are banned, and the people are given protection from raids from across the frontier. An attempt is made to improve the economic lot of the inhabitants.

To the north-east of the Naga Hills district the independent or Tribal Territory stretches away across the divide to the administered districts of Burma, east of the Chindwin. This great mountainous country, both administered and independent, is extremely difficult to penetrate for many reasons, not the least of them being the bad climate. The rainfall is one of the heaviest in the world. Mosquitoes, sandflies, leeches, and other pests make life extremely irksome for the greater part of the year. There are no roads, railways or canals in the area; and bridle-paths are few and far between. The only means of communication is by Naga paths, steep and narrow, leading from village to village

only and not along the valleys. So narrow are the paths that they admit only of single file, and sometimes the jungle hangs so low over them that a tall man has to stoop most of the time as he walks along. Transport therefore is difficult and only by coolie. As there is no food obtainable to feed a large party in the more inaccessible areas one has to rely on obtaining local porters to augment one's permanent force, as a coolie would normally eat the whole of his own load (60 lb.) in a fortnight. Languages, too, are an obstacle: there are so many and they are so diverse. We had ten interpreters, speaking between them fifteen different languages, in the course of our tour. The greatest obstacle of all is perhaps the suspicious nature of the Naga and his warlike habits. He is a great intriguer and will often try to get an enemy village embroiled with a Government column. One such attempt was made during the expedition, when Banfera went to Ninyu and told them we were coming to attack them. Ninyu had been concerned about fifty years ago in the cutting up of a Survey Party near their village. One other difficulty worth mentioning, perhaps, is that the rivers are fast-flowing and spanned only by narrow cane and bamboo bridges. There is often the risk of a sudden flood and an important bridge being carried away.

At the time that the Survey of India decided to operate in this area I, though nominally an officer of the Indian Police, was working as Sub-divisional Officer and Magistrate at Mokokchung, the subdivisional headquarters of the Naga Hills district. Previous to this I had been posted as Assistant Political Officer in the Tirap area. The Government of Assam, considering that it might be dangerous to allow a Survey Party to operate in the Tribal area without the assistance of an administrative officer who knew something of the country, recommended to the Government of India my appointment as Political Officer. Major G. H. Osmaston, M.C., then in charge of No. 15 Party, Survey of India, held charge of the survey work. As the area was largely independent, and each village in it a law unto itself, it was necessary that the party should have an escort to protect it from the raiding tribesmen, who desire not so much guns or silver but human heads as their booty. Major L. C. Bull, M.C., then O/C 4th Assam Rifles, was placed in command of the escort of four platoons furnished from the 3rd and 4th battalions of the Assam Rifles. The Assam Rifles is a Military Police force well acquainted with jungle warfare, which keeps the peace on the North-Eastern Frontier of India. It was necessary for the Survey work to post small parties of Survey *khalasis*, or coolies, with their rations, guard, lamps, and helios, on certain previously selected peaks. We decided therefore to move through the area in two parties. The first, the reconnaissance, would make friends with the local people, explore the route, and post the lampmen. The second party would confine itself to Survey work. All rations, consisting mainly of rice, potatoes, salt, chillies, *ghi* (cooking oil), and tea, we took with us. The only thing that we asked of the area was meat. I engaged a permanent coolie force of two hundred men in the Mokokchung Sub-division to carry the rations and kit of the escort. Recruited entirely from the Sema Nagas, the coolies were men of a tribe which had proved its worth in the past, many of them having enlisted in the labour corps in France during the Great War.

We had to move fast owing to the peculiar nature of the country. Up to the

1/1 500 000
Scale of Miles
Route .....
Unadministered tribal boundary
SADIYA FRONTIER TRACT
LAKHIMPUR
Dibrugarh
Sibsagar
Jorhat
NAGA HILLS
Mokokchung
Singkaling Hkamti
Nampuk
Nampha
Kamaing
Myitkyina
Hukawng
Tanai
Maingkwan
Dalu
Hkinkui
Ledo
Margherita
Namsang
Bhojo
Taukak
Longting
Sangsya
Sangnyu
Tang
Chingha
Chingnyi
Wakching
Tobok
Chen
Yongnyu
Mokokchung
Nagamimara
Hatiborg
Khimungpani
Tutnyu
Lapu
Yothung
Molo
Yongnu
Nankongo
Ramu
Kachaing
Shangke
Nokpet
Okhulokha
Yamong
Kiangge
Yarung
Ningbyen
Shingbwiyang
Hkaki
Gem Ga
Dangri Bum
Kaunggyan
Hkamti
Hkamti Long
Hkamti Ma
Hkinkui Ga
Hkinkui Gyaster
Hukawng
Tanai
Maingkwan
Myitkyina
Nampuk
Nampha
Kamaing
Ledo
Margherita
Namsang
Bhojo
Taukak
Longting
Sangsya
Sangnyu
Tang
Chingha
Chingnyi
Wakching
Tobok
Chen
Yongnyu
Mokokchung
Nagamimara
Hatiborg
Khimungpani
Tutnyu
Lapu
Yothung
Molo
Yongnu
Nankongo
Ramu
Kachaing
Shangke
Nokpet
Okhulokha
Yamong
Kiangge
Yarung
Ningbyen
Shingbwiyang
Hkaki
Gem Ga
Dangri Bum
Kaunggyan
Hkamti
Hkamti Long
Hkamti Ma
Hkinkui Ga
Hkinkui Gyaster
Singkaling Hkamti
Dalu
Maingkwan
Tanai
Hukawng

middle of October the hills are enveloped in clouds, and there is only a very short season until the smoke haze from the jhuming operations at the beginning of March blots out the helios again. Jhuming is the process of burning down the jungle to fertilise the fields before the crops are sown. Even so, the greatest difficulty was found in establishing contact during the whole season, most of the observations having to be made by lamp in the biting cold late at night.

On October 20, zero day, the whole reconnaissance party, except for those who had gone ahead to the Tirap area to arrange a ration base for operations, assembled at the railhead at Naginimara. On the 21st, having augmented our permanent coolies with some three hundred temporary ones from nearby villages, a process we repeated the whole way, we started out on our first day's trek, Wakching, a large Konyak Naga village at 4200 feet, being our objective. (Naginimara is only 350 feet above sea-level.) Wakching is one of the most north-easterly villages of the administered Naga Hills district. Dr. Von Haimendorf, an Austrian scientist, has recently come to this village to make a study of the Konyaks, a tribe or collection of tribes of whom very little is known. The men here, though good porters, are addicted to opium, a habit which happily is steadily decreasing. The next day we descended to the Sinyang River, the boundary between the administered Naga Hills district and the independent or Tribal area. The two powerful *Angs*, or sacred chiefs, of Chui and Mon came to meet us at the river. They both control large confederacies of villages. A number of his men had accompanied the Ang of Chui to our camp, and after exchange of gifts, a *mithun* for a bottle of rum and a hank of red wool, they danced for us. They dance moving slowly forward in two circular parties, flexing the knees whilst raising the *dao* (sword) and twisting it rapidly in the half-opened hand. Chui's song told us about what they were going to do to their enemy Totok when the Survey Party had gone away, for Government had forbidden hostilities here whilst we were working in the area. The Ang of Lengha, a "son" of Chui (junior villages of confederacies are known as "sons"), was rather upset as, though his village had wrested a head from Totok, they had not been able to perform the final step, in the necessary spirit-capturing rites, of hurling a spear or firing a gun into a tree on Totok's land before Government's decree forbidding further hostilities had arrived. The idea in taking a head from another village is that you bring away some of the soul force of that village in it.

The next morning, crossing the Sinyang, we entered Tribal territory, a region which is out of bounds to the ordinary traveller, and the column took up formation. Guide, scouts, advance guard, officer, porters, baggage guard, porters, rear guard, all in single file and ready for any sudden attack. Our temporary coolies were drawn as far as possible from villages ahead, so that there might be less chance of any sudden desertion. Near Totok Chingkho, where we spent the night, was Totok Chingnyu. Here stout defences against Chui had been erected. The village is built on the edge of a long, steep cliff, some 150 feet high. Entering the village along a narrow causeway with high bamboo fences on either side, we had to be very careful of the *panjis* (pointed bamboo stakes) hidden amongst the dead bamboo leaves. One of these stakes has been known to pierce right through the leather into the foot of a booted sepoy. On the 25th, continuing south-east, we descended 1500 feet to the

Sinyang River

Crossing the Tupi River

The Ang of Sangnyu

A Yongkuk. Sadiya Frontier Tract

The Ang of Totok

Head-hunting trophies on the end of a house wall in Chen

The Ang of Yansa and two cousins

Tupi, another of the tributaries of the Yangmun, or Yangnyu, as it is sometimes called. This river is an important one in Konyak legend, as most of the tribes say that they migrated down its valley from the south. It rises to the east of Mokokchung in a country now occupied by the Chang tribe, which has a culture very similar to that of the Konyaks. A peculiar feature of this country, which is also met with in that described by Mr. Mills, is the number of streams and rivers that flow at right angles to the course that they must eventually take to reach the Brahmaputra.

After crossing the Tupi we climbed the 4500 feet to Chen, a village that has not been visited since Woodthorpe passed through on a survey in 1876. Despite many disquieting rumours to the contrary, our reception was friendly in the extreme. The village, the largest in the Naga Hills, is built on one of the main spurs of the Patkai only a few miles from the summit of one of its highest peaks. Where the village is constructed the spur branches into three. The village is so placed that it commands the approaches to all three spurs. Artificial defences are practically non-existent; presumably its size is considered to be sufficient warning to the intending intruder. I tried to count the number of houses, but had to give it up as a bad job. The houses are not built in rows like in most other Naga villages, but are built here and there on any piece of ground which offers a flat space for a floor, and between the houses are small patches of high scrub jungle, occasional trees, and clumps of bamboos. Near the village, even up to 7000 feet, the fields are covered in rows of pollard alders. The land is therefore richer and produces excellent crops of millet in a rotation of only three to four years. Dr. Hutton found these alders too when he visited Angphang, a village further south. This was in strange contrast to the country we traversed from Naginimara, where trees are practically not to be seen. No rice worth speaking of is grown, and the people appear to live on taro, Indian corn and millet. On the peak above Chen, at 7910 feet, the Survey Officer built his pillar, and the lampmen and their guard were posted. The summit was covered with light prickly bamboos and oak trees. It is at this point that the Patkai, the backbone of the Chindwin–Brahmaputra watershed, bends north-east from its south-to-north bearing. Looking east from the summit the view of both the Chindwin and Hukawng valleys is completely obstructed by the Sangpan range, which, though actually a spur of the Patkai, is on the average higher than it and runs parallel. This spur is roughly 60 miles long, and between it and the Patkai flows the Dilli or Nampuk Hka. The Patkai is provisionally the boundary between the provinces of Assam and Burma, but it has not yet been demarcated. Our Survey Officer however decided that the Patkai range as at present sketched in on the map is half a mile too near Burma.

From Chen, after a struggle to obtain coolies—Chen had threatened to withhold supplying them unless we destroyed Nanwang, an enemy of theirs—we moved downhill again to Sengha Chingui. The latter is a large, clean, well-run village of about three hundred houses. A patrol path runs right round the hill on which the village is situated. We were conducted along it, as it would have been exceedingly dangerous to have allowed the Chen coolies to pass through their enemy's village. Shortly after we left here Sengha wrested two heads from Chen. The men of Sengha wore white *lengtas* with coloured

embroidery on the ends. The *lengta* here is a long strip of cloth which is hung over a cane belt and hangs down as a flap in front. In their hair, which is uncut and done in a bun on the back of the head, were wooden skewers with tufts of variously coloured goats' hair. They were all wasp-waisted, a peculiarity of the Konyaks, where the waist is drawn in very tightly by two or three circles of thick cane which are tied on from about the age of puberty. I almost succeeded in touching fingers and thumbs round the waist of one young buck. The women were more becoming than the usual Konyak type, perhaps because they did their hair more carefully and were cleaner. This was by far the cleanest and best-run Naga village of any that we visited.

From Sengha we crossed the Titu, a tributary of the Tupi, to Tang, where all the surrounding hills were covered with thatching palms. We had to change coolies on the march, as Tang is at war with Sengha and refused the Sengha coolies permission to come on their land. Beyond the shouting of a few very choice epithets at each other over the heads of the line of sepoys, the change over passed off smoothly. From Tang we proceeded *via* Longphong to Hang, or Sangnyu. Sangnyu is the parent village of one of the most powerful confederacies in the Naga Hills. It has no fewer than seventeen " sons." As each son has to build a portion of the Ang's house I was not surprised to find it the longest in the area, 123 yards. There was one fairly recent head-hunting trophy on a small platform in a rubber tree opposite the Ang's house. It had come from Wangkham, a disobedient "son." From Sangnyu we continued along the ridge to Sangsa, then descended to the Teijat and climbed again to Longting and so to Yansa (Joboka), where our next pillar was to be built. This country has been visited more recently by expeditions. At Yansa our reception was very cordial. I had not been quite sure of what might happen here as the Ang had only died a few weeks earlier. He had come to my court at Mokokchung in connection with a land case, and had sworn an oath immediately after I had told him that persons, even Angs, who swore false oaths died quick. He had returned to his village and was dead in three days. After completing the pillar at Yansa we descended into the plains on November 5, arriving out of the hills at Taukok Tea Estate. The next day, entraining at Bhojo, we reached Margherita, the last station but one on the railway. The railway, except for a short colliery line, comes to an end at Ledo. From Ledo many years ago a line was surveyed through to Myitkyina in Burma, but expense and lack of trade support has prevented any further move in this respect.

A few miles to the east from Margherita we entered the hills again, 60 miles north-east of where we first did so. I was met by the Wang of Namsang, who is supposed to be the most influential chief in this area. He was dressed like a lower-class plainsman, and the only thing Naga about him was a string of beads. Taking him with us, our first day's march was to Soha (Dangar Khuragaon). We passed through three small villages on the way, "sons" of Namsang, who had supplied our coolies. Ear ornaments of fretted horn disc against a background of conch shell were here in great numbers. Professor Balfour had asked me to keep a look out for them. The people of the Namsang Confederacy (Longchangs) do not go in for the wasp-waists, though they wear as many as six or seven circles of thick black cane round the waist. The front

of the head is shaven and the hair is grown long and worn in a bun at the back. They wear a light-blue apron, which hangs down before and behind after being wound round the waist and drawn between the legs. I saw only one or two tattooed chests—most Konyaks tattoo their chests. The men looked heavier than the Konyaks to the south. Their houses were built on stilts entirely off the ground, and thatching palms, not grass, used for the roofs, more like Singpho or Kachin houses. In the *morungs*, or bachelors' clubs, were huge hollow tree trunks, which are used as drums. In other parts of the Naga Hills these drums are carved and hollowed out from solid trees and dragged up to the villages with great ceremony. The Namsang people, contrary to custom elsewhere in the Naga Hills, cremate their dead, but they bury the bodies of those who die with any blemish or cut in the skin.

The next day we descended steeply 900 feet to the Subong stream, and climbed 3700 feet to the summit of Subong, Point VII, as we had named it. Having completed a pillar here we moved on the next day down the spur to Changyak. As the chief of Namsang had guaranteed the safety of the lampmen we left no guard. Changyak is the parent village of another confederacy, which holds sway as far south as the headwaters of the Tirap River. It is a surprisingly small village to be the head of such a large confederacy, but it lies on one of the main routes to the plains. Continuing *via* Watlom we reached the Tirap Valley on the 10th, and the South Tirap outpost and the Rangpang country the next day. The Tirap outpost is a small stockaded timber fort on the right bank of the Tirap, guarding a bridge on one of the most-used routes to the bazaars of the plains. Part of the Tirap Valley is administered by the Political Officer of the Sadiya Frontier Tract, but it was only taken over for administration by the Government of Assam in 1926. Our rations had all arrived at the outpost and after two days' rest we started out again.

Marching the first two days along the right bank of the river, the third day we crossed it and camped at Phongsa. Thus doing we passed through the Moklum, or Langlum country. This small tribe, inhabiting eight villages on the slopes between the Patkai and the Tirap, is perhaps one of the least-known in the Naga Hills. They say they have no affinity at all with any of the other surrounding tribes. They speak a different language, dress differently, and wear their hair tied into a large bun right on the top of the head. In appearance the most striking feature is their thick lips and rather large mouths. Seven of their villages fall under the administration of Sadiya, only the parent one, Longchang, lying in the Tribal area. They seem to be less developed than the other tribes. I saw one woman weaving; she was slowly pushing the ball of cotton between the weft and the warp. The shuttle has not reached them. I was surprised to see, though, how much in the last few years they have fallen under the influence of the Singphos (Kachins) as regards dress. The Phongsa people are like the Namsang lot, though Phongsa is a "son" of Changyak. The upper part of the forehead is shaven, the hair is drawn back and worn in a bun at the back of the head, and through this bun is stuck a most unusual type of skewer made from the pared and polished rib of a deer or buffalo. The end of the comb is covered with shellac. The only interesting thing I noticed about the women was their tattooing on the upper arm and shoulder. From Phongsa our path continued along the left bank of the

Tirap, gradually losing height as it passed through the villages of Changra and Tutnyu to the confluence of the Sumhak and Sumnu rivers which form the Tirap.

On the morning of November 18 we moved up the Sumnu valley and camped at Noglo. The coolies who took us there, though late, came from the two nearby villages of Layu and Kothung, and it was a wonderful sight to see both parties streaming down the sides of the valley with the early morning sun glinting on their *daos*. We passed through Layu on the way to Noglo. It has four hundred houses and twenty-one morungs, the largest village in the valley. The houses, as usual for this area, were built on stilts, but some of the main posts were sticking out through the roofs as in the Konyak country. It looks untidy but is really a most excellent idea, as, when the portion of your main post embedded in the ground rots, you merely cut it away and drop the post again into the ground without either having to rebuild your house, or buy a new main post and drag it up to the village with the attendant expense of a feast for the workers. The Layu people came of a different tribe to those encountered hitherto, although I could find no other name for the people but that of their village. The Ang, or sacred chief, is known here as Lu- or Lo-Wang—and contrary to the Konyak custom he is not bound to marry a woman of the same clan. He must however marry into noble blood and has a choice of two clans from which to do so. A feature of the chief's house, where I went for a drink, was the ladder leading to the verandah. It was hewn from a single block of wood, quite 15 feet long by 2 feet wide by 1 foot deep. Noglo was our base for the assault on Point VIII, a peak on the Patkai 9120 feet high. We spent from November 19–24 here. From Noglo onwards up the spur of the peak was a mass of very heavy jungle, and we had great difficulty in finding water both for a half-way camp and, too, anywhere near the peak for the troops and lampmen to be stationed there. We were hoping to get a good view of the plains of Burma and Assam at the same time from the peak, but the weather was much too cloudy, and it was only for seconds at a time that the Survey Officer was able to get his lines on other peaks of the series. Some idea of the density of the jungle on the summit may be gained when I say that it took an average of one hundred coolies three days to clear six lines for observation.

Our work at Noglo completed, we returned through Layu to the confluence and double-marched to Nogna on the right bank of the Tirap. This village was strongly fortified, the only one in the valley that had any defence beyond its natural fortifications. They live here in constant dread of raids from Nauknyo, a large village in the Nampuk Valley, some 40 miles away, across the Patkai. My dog here fell into a pit of *panjis* and was lucky to escape with its life. We had crossed a rickety bamboo bridge over a moat only a few moments before, never suspecting what was below. From Nogna we hurried back to Khimyong, a Moklum village, and by forced marches to Okhutohap, a pass on the Patkai at some 6000 feet, trying to make up the few days we had lost at Point VIII. At Okhutohap, Monka, chief of the Rangpang village of Punyung, greeted us with his coolies and pointed out an egg dressed with two feathers tied to the top of a stick planted firmly in the ground. He told us that he had done this as he heard that the Survey could not work in the rain, and

The Tawa Hka near Shingbwiyang

Coolies crossing the Taga Hka near its source

New Buddha arriving at Dalu

The mouth of the Tsamak Hka

Tanai River gorge above the Kyaukse rapids

Pulling the dug-out round the Kyaukse rapids

this was a certain preventative. The charm certainly worked, as for a whole week to come it never rained once. We wished we had met him sooner. From Okhutohap we made a sortie from our ration base in Assam and established a lamp squad with its guard on Mu Bum, a peak 8200 feet high on the Sangpan Range which I have mentioned earlier. This range, really a spur of the Patkai, leaves it some 8 miles north of Okhutohap and a few miles south of the Nawngyang lake. We were sorry that we had no time to visit this lake, which is at 3000 feet near the summit of the Patkai. It is about $1\frac{1}{2}$ miles in diameter and is surrounded by a marsh quite 8 miles long by 2 miles broad. The waters of the lake flow into the Loglai, thence to the Tarung and so southwards to the Chindwin.

The assault on the Bum was made with the aid of Rangpang coolies from the administered area of the Sadiya Frontier Tract. Our route lay *via* Hepachet Hi, a transfrontier Rangpang village, to the site of the deserted village of Shangke, some 2000 feet up the Sangpan towards Mu Bum. From Shangke we had great difficulty in getting to the summit owing to lack of adequate water supplies and also to the fear of the coolies to come with us, as they said the mountain was infested with tigers. We certainly saw three in two days. One night in camp near Shangke, whilst the scouts had gone ahead to search for water, the coolies suddenly raised a terrific scream, causing a great flurry in camp and the turning out of the guard to man the perimeter, for we built stockades every time we camped. The scream was a most eerie one, first started by one or two men and gradually growing in volume till the whole two hundred men were yelling at the top of their voices and then gradually dying away till only two voices could be heard and then complete silence reigned again. It turned out to have been a were-tiger which had passed through the Rangpang coolie lines. Its tracks certainly showed five toes, which the Rangpang will tell you is a sure sign of a were-tiger.

Having eventually completed our pillar, we returned to Okhutohap and descended the Assam side of the divide to the river Namchik, a tributary of the Tirap, to pick up more rations, and the next day climbed again to the summit of the Patkai, to a pass at 6257 feet, from whence we were to make our dash to the ration base in Burma on the Chindwin. Our route lay *via* Telekkuk, a small village of about seven or eight houses and very typically Rangpang in this respect. The people here are of the Langshing clan and, as we found in all but a few Rangpang villages, dress entirely like the Singphos, having learned to make their cloth. The dress consists of a tartan *lunghi* or skirt, usually of blue, green or red check design; a short wide-sleeved blue coat buttoning down the front and a tartan *pugri* wound round the hair, this latter sometimes worn at a most rakish angle by the young bucks. Slung over the right shoulder and passing under the left armpit is a cane band to which is attached a sheath for the indispensable single-edged *dao*. Tied to the cane are half the lower teeth of a tiger. A few twisted strands of elephants' hair are worn round the upper calf. The women, too, dress like the Singphos. They wear a long black skirt reaching almost to the ankles. Over this is worn a short light-coloured skirt which reaches half-way down the thighs. A short-sleeved bodice usually of a dark colour and a light cotton cloth thrown over the shoulders completes their dress except for a white *pugri*. Heavy brass bracelets

are worn on the arms and sometimes a few strings of glass beads round the neck.

Leaving Telekkuk we descended to the Taiyong, one of the main streams forming the Tarung, one of the chief tributaries of the Chindwin. Crossing the Taiyong we climbed to Litu and descended again to this river, passing only two small hamlets on the way. At the Taiyong we found an old bridle-path constructed by the late Mr. Dewar, Sub-divisional Officer of Kamaing when he came this way from the Hukawng valley on the human sacrifice abolition expedition of 1930–31. We followed this bridle-path along the Taiyong, later called the Namyung, occasionally crossing the river to where there was the easier going. In some cases we were obliged to ford the river and in others crossed on low bamboo bridges, temporary affairs which had been constructed a few days previously. All the way along the river was dense bamboo jungle overshadowed by huge trees. We camped on the night of the 15th at the confluence of the Taikham. Not even here could we get a glimpse of the surrounding hills, though the valley had broadened out considerably and the river-bed was quite 50 yards wide. The river was teeming with *mahseer* and *bokha*, and both Major Bull and I would have liked to have sent in our resignations and camped here for the rest of the year. We moved away from the river next day, south, through Tagap Ga and on to the deserted site of the village of Nathkaw. Here we climbed again to just over 4000 feet, the ridge being a spur of the Sangpan range. From Nathkaw we continued for the next few days along the disused bridle-path, dipping ever lower towards the Hukawng valley, of which we caught only occasional glimpses, for it seemed to be eternally shrouded in mist. On the 18th we arrived at Shingbwiyang, a small Singpho hamlet of about four houses on the left bank of the Tawa Hka, a river which flows south to the Chindwin. From the Patkai to Shingbwiyang we only passed through two miserable villages. The Rangpangs populate an immense area very thinly indeed. We were welcomed at Shingbwiyang by old Nawm Kawm, the chief, a useful old man with a wicked glint in his eye. He claims overlordship of most of the Rangpangs. They acknowledge this claim and bring him yearly presents of fowl and pigs. On the Assam side it was the plainsmen who would bring presents to the Nagas. Shingbwiyang is in the extreme north-west corner of the Hukawng valley, which has only been administered by the Burmese Government since 1934. The Hukawng valley is a large circular pit some 150 miles in circumference, embracing the four main rivers, the Nambyu, Tawang, Tarung and Tanai, which form the Chindwin. A peculiar feature of its south-eastern extremity is the low, narrow belt of hills only 1000 feet high which divide it from the Mogaung valley, the Mogaung being one of the main tributaries of the Irrawaddy. The Hukawng is rich in gold and precious stones. Amber is also found in quantity but the mines have closed down as there is little sale for it now.

Between Shingbwiyang and the Tanai lay a dense mass of swampy jungle, through which we hacked our way for eight hours until we eventually burst out suddenly on to the glorious sight of the broad fast-moving Tanai River. The banks where we emerged from the jungle, a few miles above the mouth of the Tawa Hka, were steep, and the bed of the river a mass of large rounded stones. Where the river curved were huge sand-banks. Close to our camp a

few Shans from Ningbyen, a village upstream, were washing for gold. The gold is not to be found in any quantity and is very soft. When the harvest is in however the gold rush commences and the local people, by washing, can find as much as three rupees' worth in the day.

I had sent word ahead for boats; they arrived on December 23, and we managed to get everybody and everything off that evening, though it was very late when we started. There were in all fifty dug-outs of various sizes, which the boatmen lashed together securely in pairs. Night came on as we were only a short distance downstream, but before then we had luckily shot a difficult rapid, not marked on the map. We had some anxious moments waiting for the last boat to come through in the dark, as the men were inexperienced and did not know the channel. We camped for the night 9 miles downstream. The next day, Christmas Eve, we hoped to reach Dalu, but had to tie up for the night at the mouth of the Ahawk Hka, having gone only 17 miles. The boats were loaded so heavily that we could not move much faster than 2 to $2^1/_2$ miles an hour. We completed the last 6 miles to Dalu on Christmas morning. Dalu is a mixed village of about sixty Shan and Singpho houses. Close to the village we found our rations under the care of the chiefs. They were being brought up by mule convoy from the railway at Myitkyina, sixteen days away by bridle-path. Despite the pleasure with which we were greeted it was only with the greatest difficulty that I was able to buy a buffalo for the Sema coolies' Christmas dinner. In the evening the Semas danced for us and we all listened-in to His Majesty King George's Christmas Day message on my wireless set, which, despite several crashes on slippery paths and at least two immersions in rivers, was still working well.

Our next objective was just visible from Dalu, Lungwukaw Bum, a towering peak on the Sangpan Range. We stayed two days in Dalu and on the morning of the 28th ferried the whole party across the Tanai in dug-outs. We marched first along the bed of the Taga Hka for a few miles, and then struck west across its valley to the Tayup Hka, another smaller tributary of the Tanai. All the way along the banks of the Tanai and Taga were opium fields with the poppies a blaze of colour, a beautiful but sad sight. The next day we continued along the left bank of the Tayup some 500 feet above the river to come down and cross it below the village of Wanka. We had intended to attack the Lungwukaw Bum by climbing to the summit of the Sangpan along the Gum Ga-Rangsen path and then to cut our way along the top of the ridge to the peak. On reaching the vicinity of Punlum, a village near Gum Ga, we found however that both these villages had moved their sites some few miles to the east, since the area had been last visited and the chief of Punlum advised an attack on the peak by getting to the summit of the range along the Gum Ga–Risa–Ranu path. Following his able advice, after spending a night at Gum Ga, a Rangpang village of about thirty houses, we turned north through Risa and, continuing for some 12 or 13 miles, found ourselves on the Yangme Hka. The next day we climbed up the path till the barometer registered 6000 feet and, after cutting and hacking our way for about three hours, or half a mile, round the side of the spur, we eventually came upon a cataract with a fair volume of water. The sides of the mountain were far too steep to make any attempt at a camp, and we just spread

out and lay down wherever we could severally find a ledge sufficiently long and wide. Next day, retracing our way to the Ranu path and continuing along it, we reached the saddle between Lungwukaw and Pungra Bum, another peak at 8690 feet. Here we found water, and whilst the Survey Officer and the troops proceeded to do their work on the summit of Lungwukaw Bum I climbed Pungra Bum, and here, at last, was a wonderful view of the Nampuk valley with the Patkai towering behind it. The valley is obviously over-populated, the slopes on both sides are bare and treeless. I could make out the huge villages of Yangno and Ranu, Rangse and Nauknyo, all containing well over one hundred houses. This over-population seems surprising when one considers how terribly under-populated is the area on the other sides of the Patkai and Sangpan in the Rangpang country. I did not meet many people from the Nampuk valley, but they all have a resemblance to the Konyaks rather than to the Rangpangs. Some of the people I met from this area later in Singkaling Hkamti were very similar to the Chang tribe, just to the east of Mokokchung. The most striking similarity is a design like the marking on the catfish which the Chang women tattoo on their foreheads; one of the tribe's ancestors is stated to have been one of these fish. There is a very gradual movement taking place from this area to the plains round the Tanai, the Nagas migrating down to the banks of the river rather than living on the practically uncultivated eastern slopes of the Sangpan. No Naga would live in the heat of the plains if he could get his living in the cool of the hills, but I could find no reason for their non-occupation of the eastern slopes of the Sangpan.

Completing our work on the peak we returned as we came and were in Dalu again on January 7. Spending two days in Dalu I moved off again north-west, to effect a liaison with Major Osmaston's party who were due at Mu Bum on the 18th. This time we marched along the left bank of the Tanai for two days through extremely dense jungle. There was no path and we found that by wading in streams we could get along easiest, though our feet often got numbed with the cold. We crossed the river by dug-out where we had first taken to the rafts and pushed along our old path to Shingbwiyang (how the signallers used to hate that name!). Here we found an old bridle-path going our way and were able to make use of it through Shamshing, Hkalak and Kachaing to Sanching at the foot of a long spur rising due north to Mu Bum. In Kachaing and Sanching the Rangpangs appear to have maintained more of their own culture than elsewhere. In Kachaing was a grave underneath a rice granary. It is customary to bury sometimes in such a place in lieu of under the house. On the path just outside the village were some lightly built bamboo arches. Hanging from these were a few cone-shaped hats and some split-bamboo clappers. The demons are driven out of the village, I was told, by the whole population dancing through the village shrieking and shouting and beating gongs, clappers and drums. When the exhausted mob has reached the arches the clappers and hats are hung up on them and the demons are out of the village for another whole year.

Sanching, a village of some forty very large houses, was the biggest Rangpang village we came across. The Rangpang family all live in one house, each part of the family having its own room, which leads off to one side of a long

passage running the full length of the left side of the house. The Rangpangs are, or rather were, human sacrificers: the Governments of Assam and Burma have done their best to put down the evil practice. In Sanching they told me an interesting story of the foundation of the custom. In the past, they said, they had always sacrificed monkeys, but one day, when sacrificing one, a voice was heard to come from the sky. "Of what use is a monkey?" and at the same time a human hand fell at the feet of the sacrificers. The priests interpreted this omen to mean that the spirits required a human being to be sacrificed and, though they hated doing it, the practice was started rather than that the tribe should die from disease or starvation. This tribe is rather different in one respect from all the other tribes encountered. A man must marry into his own clan. There are so far as I could gather twenty-one clans, each of which confines itself to a village, and usually the village is just named "the men of so-and-so clan" instead of being called after some nearby feature.

Leaving this interesting village on January 19 we climbed the mountain to find Major Osmaston had already arrived. We stayed here on the 19th, the temperature in the night being 26°. There were a few inches of snow on the ground, but we were not the worst off, as news came through by helio that there were 2 feet of snow on the summit of Point VIII at 9120 feet. I had here my first opportunity of watching the observations being made, and it was rather a wonderful experience sitting in the complete stillness with the lamps winking at one from the distant hills in all directions. The Himalayas were distinctly visible to the north and north-east: an unbroken line of snowclad peaks. The Patkai unhappily shut off our view of Assam. On the 20th we moved down again to Shangke, and, taking a short cut to the Namyung, returned *via* Shingbwiyang to Dalu. On January 22, on the way down to Namyung, surprised at the silence from the Empire Broadcasting Station, I tuned in to Germany to hear the announcer say in English "the German nation joins with the British nation in mourning the death of her beloved Sovereign."

On March 1, owing to impossible weather conditions, Major Osmaston decided to close down Survey operations for the season. On the same day a new brass Buddha arrived by river at Dalu, having been brought from Mandalay. We must have been rather a nuisance to this village with our continual call for eggs, fowls, goats, pigs, and buffaloes, and I am sure they connected these two events to the glory of Buddha and the impotency of the unbeliever as typified by the Survey Party. There was great commotion on the river bank as it was brought in. One small boat paddled by two men did continuous circles round the raft as it headed slowly for the bank with a band of drums, cymbals, gongs and bells in full attendance. The idol was then hoisted on to a decorated bamboo platform and carried up the bank in procession to the chief's house in the village, where it was left pending its removal later to the Pagoda. Having said good-bye to the Survey Party, which was returning *via* Maingkwan and Kamaing to the railway and thence to Rangoon, we set off down the Chindwin on our way back to Assam, half the party marching and the balance in the dug-outs. I do not think any of us were at all sorry to be leaving Dalu, a most dismal spot, where the ground mist forms at about 9 o'clock in the evening and lasts till nearly 4 o'clock the next afternoon.

On March 11 the river party reached the first of some difficult rapids to be negotiated, the Tsamak series. Here everybody disembarked except the boatmen, who set off with the loads left in the boats. The rapids extend over half a mile and there are four really bad places, the worst directly opposite the mouth of the Tsamak Hka, which comes in on the left bank of the river. Things had been made more difficult by an abnormal drop in the level of the river, which had left many more dangerous rocks to be negotiated. The dug-outs which were joined together in pairs for added stability all got safely through the upper rapids, but the second raft as it passed through the next rapid struck a rock with such force that the two dug-outs were wrenched apart and the six boatmen and all the loads were flung into the river. They were all rescued, the only loss being a few bags of rice. The next raft to come down did the same thing, but it was rather worse, as one of the boatmen got caught under water between the two boats and was in serious danger of drowning, until one of the men left on the wreck with great presence of mind seized his *dao* and hacked the two boats apart, despite the fact that they were then full of water and careering towards the head of the next rapid. This being quite enough for one day we camped at the head of the next series, the Hinkiu rapids, and dried everybody and everything in the hot sun. The next day we had to unload everything, and the dug-outs were pulled separately through the water whilst the loads were carried to the bottom of the rapids along the steep rocky sides of the gorge: a most laborious process. The second rapid was negotiated by shooting it. In every case the boats were swung around and one boat always filled with water. Then loading again we floated downstream some 6 miles to the head of the Kyaukse rapids. The river here is very narrow, being only some 20 yards across as compared with the width at Dalu of some 600. The Chindwin is 519 feet above sea-level at the rapids, so that a dam here about 150 feet high and 200 feet across would flood the whole of the Hukawng valley. Dalu itself would be 50 feet under water. There is a sudden drop of 7 feet in the river-level at the Kyaukse rapids, so the boats had to be taken out of the water and pulled round. The boatmen built a framework of large branches much like the Konyaks do when they are pulling up a new log gong to the village and the boats were pulled over, one by one, with cane ropes. On the 14th we reached Man Pang, a Shan village of some sixty houses, and on the 15th Singkaling Hkamti, where we linked up with the land party who had had an uneventful journey along the right bank of the river to Sailung, where they ferried across it.

Singkaling Hkamti is a large clean village of about sixty houses and capital of the State of the same name. There is a pagoda (temple) and a *kyaung* (monastery) with many saffron-robed monks. The Sawba, or prince, a pleasant young man who smoked eternal perfumed cigarettes, sent down his chief minister to welcome us. After staying here two days in the forlorn hope of the Government launch coming for us, as previously arranged, we left on the 18th for Homalin, half the party, as before, going in the boats. Camping each night at a Shan village as we progressed down the river we arrived at Homalin on March 25. Homalin is the headquarters of one of the subdivisions of the upper Chindwin district. Making use of the Government launch, the *Northern Ranger* (which had been unable to get up to Singkaling

owing to the abnormal fall in the level of the river), and the Irrawaddy Flotilla Company's regular steamer, we reached Sittaung on the 27th, 90 miles from Homalin and 350 from Dalu. From here, marching along the bridle-path by night as the days were too hot, we reached Tamu on the Assam–Burma frontier on the 30th. On March 31 we entered Manipur State and reached Imphal, the capital, on April 3. Here we engaged a fleet of lorries, and, motoring over the hill road, arrived in Kohima, the headquarters of the Naga Hills district, on April 5, exactly 170 days after starting.

The Naga Hills—a beautiful country and a happy and lovable people. May they long be spared from the terrible consequences of Western Civilization.

DISCUSSION

Before the paper the CHAIRMAN (Admiral Sir WILLIAM GOODENOUGH) said: We are all the more sorry that the President cannot be here to-night because he has actually been in the country that we are to hear about. The account of it is to be given by Mr. Lambert. Mr. Lambert is a Police Officer who has been in the Political Service for some time, and who accompanied a Survey of India party which was engaged on the triangulation starting from the great river which bears the name of the son of one of the trinity of gods of India, the Brahmaputra. The journey that we are to hear about extends across to the Chindwin, which is a river tributary to the Irrawaddy. The people who inhabit the Naga Hills are the people called the Naga. Whether mongoloid or australoid or a mixture of both perhaps we shall be able to know after we have heard the lecture. It is particularly of the people that we are to hear in the lecture which I now ask Mr. Lambert to deliver.

Mr. Lambert then delivered the lecture printed above, and a discussion followed.

The CHAIRMAN: After that very delightful description of a little-known country I am sure you would wish to hear something from Dr. Hutton, who has been four years or more as District Commissioner in the part of the world about which we have heard and with whom our President went on the journey of which I spoke at the opening of the meeting.

Dr. HUTTON: The country which Mr. Lambert has been in was last visited by a very well-known Fellow of this Society in his day, namely, Major-General Woodthorpe, who was in the Naga Hills in 1876, and by Mr. S. E. Peal, who visited the Nongyang lake in 1879. Until then most of the country was completely unvisited. I had the good fortune to visit the part further south than that visited by Major-General Woodthorpe, and an area still further south, which no one had previously been into, in 1923–24. With Captain Kingdon Ward I went as near as we could get to Saramati in my last trip to the Naga Hills in 1934 or 1935.

Some of the points raised by Mr. Lambert were of great interest. One is the question of platforms made for pulling boats round rapids. He described them as being very like the platforms made by the Konyaks for dragging the new canoe gongs up to the villages. The canoe gong is made exactly like a dug-out canoe, hollowed out of a tree perhaps 40 feet long, and played by the bucks of the village, perhaps twenty or thirty all hammering on it with things like dumb-bells. These I suspect are reduced canoe paddles, and I cannot help thinking that this gong is in origin a dug-out canoe. Manipuris used a dug-out canoe habitually as a means to signal by, beating on the sides of the canoe, and in Fiji regular signals are used and beaten by the handles of paddles hammered on the

sides of the canoes. The beating on one of these hollowed-out wooden gongs, as I prefer to call them—Professor Balfour calls them xylophones—is heard for miles across the valleys on a still night in the hills. The significance is well known from one village to another. You can tell whether it is the chief being buried, whether the village that is beating the drum has taken heads, or whether they have lost heads. I suspect that that particular instrument, curiously enough in people who cannot swim and know nothing about navigable water, is still derived from the canoe.

Mr. Lambert mentioned the burial of people under granaries. Of course many of the Konyaks do not bury at all, and the Aos do not. Apparently they prefer to smell their grandmothers as long as they can. It is a strict principle of a number of villages in the Naga country never to change the location of a cemetery. They never make a new cemetery, and in some cases an ordinary cemetery is built on the road just outside the village in order that the souls may migrate easily to the village from which the original colony came. In some cases the village grows larger, and must spread down the ridge on which it is built. As it is not possible to move the cemetery, the village street may be lined with corpses; you walk between sets of houses and then you get a row of corpses, some fresh and some old, and then you start houses again. Nobody seems to mind and nobody seems one penny the worse. The point of putting the heads under a granary is perhaps some curious connection between the souls of the dead and the crops. In some villages they wait until the body is nine days ripe and then detach the head. That is put into a phallic stone cist, and the body is exposed in its coffin in a *ficus* tree. In some of the villages I visited with Captain Kingdon Ward the body was hung up in the living-room inside a wooden canoe-shaped trough, and it would be kept there until the next sowing. If the individual dies just after the sowing the body is kept there for the whole year. If he dies just before, he will still be disposed of at the sowing, even if a little green. Nine days is the allowance. Then the body is dismembered in order that it may release the soul to go into the crop, to ensure a good harvest the following year. The bones are then gathered together and put in a pot inside the granary, and left alone there. I think there is a very definite connection in the idea of the life cycle, in which the soul of the human being goes into the crop, is eaten again and comes back into the human being. That I believe to be the meaning behind burying underneath the granary.

It is too late to enter into all the questions arising from Mr. Lambert's most interesting paper. He showed me so many old friends that I could talk about them for hours. One thing I cannot believe is that the Sema coolies could not drink all the beer offered them. The only explanation can be that they have turned Christians since I was in their country, because the Christians in that part of the world do not drink. The Semas I knew would have polished the beer off, though they might not have carried loads the next day!

The CHAIRMAN: Colonel Rich was in former years in charge of the Survey in that part of the world. I will ask him to add a word or two on the subject.

Colonel RICH: The lecture has been of special interest to me, as during three cold weathers, from 1920 to 1923, I lived in the unadministered tribal country described by the lecturer, on the east or Burma side of the Patkai Range, whilst in charge of the Survey of the Hukawng valley and the watershed of the Chindwin River to the north and west of this valley. The photographs we have seen of some of the leading chiefs are those of old personal friends, and I have camped in many of the villages shown on the screen.

It was known to the Government of Burma that the Kachin tribes in this area owned large numbers of domestic slaves of their own race, and I was

ordered not to interfere with them, unless any of these slaves were found to be Indians, in which case they were to be bought from their owners at the current market price and liberated. During the course of my tours round the valley, I came across a few of these Indian slaves and bought them their freedom at an average price of £5, except in the case of a few of the older ones, who had lost all touch with India and were quite happy to remain as they were with masters who treated them kindly.

During my second year, when the Survey had gone further west towards the Patkai Range into the tracts inhabited by Naga tribes, my surveyors began to send in reports of evidence they had seen of recent human sacrifices. I sent these reports to the Burma Government, but they were inclined to consider them as old wives' tales of practices which had not been known for many years. In the following season, therefore, I received orders to find out if these reports were authentic or otherwise, and unfortunately they turned out to be true, though only a few human sacrifices took place each year.

My surveyors also found a slave girl in one village, who was to be sacrificed during the summer when my survey party had left the locality; and after a lot of bargaining I managed to buy her from her owner for £40, and sent her out of the country to the nearest town in Burma, Myitkyina on the Irrawaddy, where she was taken care of by some missionaries. Unfortunately she became ill and was sent to the local hospital, where she was given a powder which she imagined to be poison, and during the night she went out and drowned herself in the river.

Two years later I accompanied Sir Harcourt Butler, late Governor of Burma, on his expedition to that country in 1925, when he gave orders to the chiefs that all slaves must be set free and human sacrifices stopped, and since then this tribal territory has been administered by the Government of Burma.

The CHAIRMAN: I will ask Captain Kingdon Ward to say a few words.

Captain KINGDON WARD: I believe that Mr. Lambert, who has given this very interesting lecture, is a Police Officer in the Indian Police, and I think that you will have gathered from the extraordinarily hard time that they had in the country that even in India a policeman's lot is not a happy one. Although he was talking about locating points by means of Survey Parties in the Naga Hills, I gather he was not really on point duty!

My only claim to say anything on this occasion is that two years ago, thanks to Dr. Hutton, I was permitted to walk across, in a wholly unofficial capacity, from the Brahmaputra to the Chindwin, a good deal south and by a shorter and easier route than that of the lecturer.

Mr. Lambert told us an interesting fact, that the average height of this range which runs down between Burma and Assam is about 6000 feet, and he mentioned the peak of Saramati, which he says is over 12,000 feet high. It is a very curious thing the way Saramati stands up in isolation, very much higher than the surrounding country. Thanks also to Dr. Hutton, I was able to join his punitive expedition on a sort of little holiday, and he took us to climb the peak of Saramati.

I regret that Mr. Lambert did not touch upon the botany of the country. I am afraid that is the only thing which attracts me to that part of the world. I go to look for plants, and Saramati is perhaps a floristic island. It is so much higher than all the surrounding country that probably on top there are plants which grow nowhere else in the world. Dr. Hutton, Major Hartland, and myself tried to climb the peak. We only got up to about 10,000 feet, but that was quite sufficient to whet our appetites, and we did find a possible route to the summit. I think if we had had the time we could easily have got there. If

anybody in future wants to know the route and has the time, and of course the permission, to climb Saramati I will be pleased to enlighten him. I think Mr. Lambert mentioned some one who is alleged to have gone to the top from the Burma side last year. Anyway, he did not bring down any plants; he just went up and came down again, so we are not much better off from that point of view.

The Chindwin, of which Mr. Lambert showed us some extremely graphic pictures, is a very interesting river. He showed you the great basin of the flat, low-lying Hukawng valley, and pointed out how on the Burma side the mountains between the Chindwin and the great Irrawaddy are only about 1000 feet high. Professor Gregory has pointed out that the Chindwin river is far too small for its valley; and that this valley must have been cut out a long time ago by a very much bigger river, which seems to have come down through Tibet and flowed across into the Hukawng valley over a very low gap in the mountains, called the Hukawng wind-gap. The river was probably the Tsangpo. How it afterwards managed to get switched off into the Brahmaputra valley, leaving only a miserable trickle at the source of the Chindwin, is a point not yet cleared up.

The hour is late, so I do not think I need say anything more except to thank Mr. Lambert and say how much I have enjoyed his extremely interesting lecture.

The CHAIRMAN: I should also like to thank Captain Kingdon Ward and congratulate him on his endeavour to reach the top of Saramati. There is time enough yet for him to do it, judging by his appearance. To-night it is not flowers or mountains or even country that are the principal interest. Mr. Lambert has discussed mostly the people who live in the country he visited, people who live under a civilization different from ours, but a civilization none the less, and the more we hear of different parts of the world the more it seems to me we have to realize that there are different civilizations. It may not be concerned with arms and aeroplanes and such things, but still it is civilization.

I assure you, Mr. Lambert, that you have given us an evening of very great interest. One saw, underlying the easy way in which you spoke, what we in this Society so often share: hard work, great application, immense preparation beforehand that things may go right. To come through the work with all these coolies without, I think you said, the loss of a life is a great accomplishment. When two or three Englishmen collect a big party together and take it successfully through six months' travel involving dangerous river crossings, illnesses, and disease, without loss of life or trouble of any kind, they are really achieving something that does immense credit to them as leaders.

The hour is somewhat late, though not a minute of the time has been wasted. We offer you our warmest thanks for a delightful evening and a description of really first-class interest. I understand you are going back on Thursday next, and I may say that Mr. Lambert put off starting on that delightful thing, a sea trip—he is going across to Marseilles by train—in order to give the lecture here to-night, when he might have been in the Bay of Biscay instead! So we owe him an added debt of gratitude. Thank you very much, Mr. Lambert.

THE ECONOMIC DEVELOPMENT OF THE SOVIET ARCTIC: *A paper read at the Afternoon Meeting of the Society on 15 February 1937, by*

H. P. SMOLKA

I HAD an opportunity last summer of travelling to the furthest outposts of Soviet activity in Arctic Siberia. Although a number of foreigners have been to these regions before, I can claim that I have succeeded in getting to certain towns which no one outside the Soviet has seen before, if only for the very simple reason that they did not exist a year ago. I was present at the birth of a number of settlements which are just springing into life in those regions.

We have all been aware for some time that the Soviet Government has embarked on a large scheme of navigation, industrialization, and aviation in the far north of their country. Two years ago, by Government decree, a company was formed and given an exclusive charter to explore and to develop the whole territory of the Soviet Union above the sixty-second parallel, an area of 6 million square kilometres, or thirty times that of Great Britain. The organization, called the "Central Administration of the Northern Sea Route," has now forty thousand men and women in its employ. The head is Professor Schmidt, whom we have known as commander of the Chelyuskin Expedition, marooned on the ice off the Siberian coast in the winter of 1933–34. When he was in London a year ago he explained the activities and achievements of his organization to a number of interested persons, among whom I found myself. His tale seemed fantastic to most of us. We called him a red Columbus; and when I expressed my doubts whether an unbiased non-Bolshevik would find the same rosy picture of the Arctic which he had drawn for us, he consented there and then to secure for me permission to go and see with my own eyes what was going on. I must add that normally a Russian *visa* does not entitle its holder to visit this part of the U.S.S.R. It took some time even for Professor Schmidt, who is a member of the Council of Peoples Commissars, Russian equivalent for the Cabinet, to convince the G.P.U. that nothing disastrous would result from my visit to the far north.

I made my journey by railway from Moscow to Krasnoyarsk in Eastern Siberia, which has now become a main base for the Arctic. From there I flew on the newly opened Arctic air lines above the Yenisei to Port Igarka, the new Arctic town; continued, again by aeroplane, across the Taimir Peninsula to Nordvik, and returned to Norilsk and Dudinka, a mining centre for coal, nickel, platinum and copper, for which a railway is now being built to link it with the Yenisei. I took a boat, a British tramp steamer carrying timber, from there to Dickson Island, the central radio exchange and main polar station in the Kara Sea. There I had an opportunity to watch the work of a Soviet polar station and to make a few small expeditions on board the ice-breaker *Yermak*, engaged at that time in blasting a route through the Vilkitski Straits for a fleet of cargo boats heading from Murmansk for Vladivostok. I returned on board a Russian tank steamer, which had brought fuel from Baku to vessels ploughing the Arctic Ocean, *via* the Kara Sea

through the Matochkin Straits of Novaya Zemlya and through the Barents Sea to Murmansk. Here the Russians are now busily expanding the port, building wharves and dockyards. I came down through Karelia on the " Polar Arrow " train to Leningrad, and returned from Moscow to London by air in one day.

I propose to discuss the economic development of the Soviet Arctic in the same sequence in which the Russians devote their work to it. They regard navigation as the first requirement for the opening up of these regions. Siberia is, if you will permit me to use that popular expression, a geographical freak. It is no doubt one of the richest territories on the earth. Its natural resources in minerals, metals, timber and a great variety of valuable raw materials are vast. At the same time, Siberia is one of the least accessible parts of the world. It is the backyard of Asia. Its entry to the world's seas is frozen for all but three months in the year. Its main water arteries, which would otherwise provide excellent natural means of communication and transport, flow north into the ice-bound Arctic Ocean. The one railway which cuts through Siberia (although fully double-tracked by now) is hardly able now to cope with the increasing transport and industrial requirements. It has been Russia's colony for three hundred years. Nevertheless its riches were scarcely harnessed to serve its own proprietors, not to speak of mankind as a whole. To link the heart of Siberia with Europe and America through navigation of the rivers and through the Arctic Ocean to the Atlantic and the Pacific would be a good solution of this crucial geographical problem. With these objects in mind the Soviet Government is busy organizing river transport down to the mouths of the Ob', Yenisei, Lena, Kolima, Indigirka, and Anadir, the building of ports in their estuaries, and the maintenance of sea transport from these ports to temperate regions during the short Arctic summer. Vessels are guided through the most difficult parts of the Arctic Ocean, such as the Straits of Novaya Zemlya, the channel between Cape Chelyuskin and Northland, the East Siberian Archipelago and the Bering Straits, by powerful ice-breakers.

We remember that the navigation of the North-East Passage has for centuries been a dream of sailors and merchants. In the sixteenth century, when Spain and Portugal had monopolised the southern sea routes to China and India, the English and Dutch were particularly anxious to open up for themselves an alternative route round the world. Robert Thorne, a merchant in Bristol, wrote a long memorandum to Henry VIII imploring him to take upon himself the task of opening up the northern sea route for the benefit of England. Sebastian Cabot's Company of Merchant Adventurers did in fact equip a small expedition consisting of three ships under the command of Sir Hugh Willoughby. They perished off the coast of Lapland, and all that was achieved at that time was the conclusion of the first Anglo-Russian trade agreement between the Duke of Muscovy and King Edward VI. In the seventeenth and eighteenth centuries the problem receded into the background of mere scientific interest. With the destruction of the Armada it was no longer of vital interest for England to reach Cathay *via* the north. Exploration of Arctic Asia in the eighteenth century was done by land. It was Peter the Great who ordered the mapping of the coast line of his Empire.

Siberian merchants and English sailors rediscovered their interest in this northern sea route in the second half of the nineteenth century. Captain Wiggins, largely financed by public subscription through *The Times*, successfully concluded a number of journeys to the mouths of the Ob' and Yenisei. Nordenskiöld, backed by Sibiriakoff and the Swedish financier Baron Dickson, set himself the task of sailing round the whole Siberian coast and concluded his journey successfully in 1876, yet only by spending one winter *en route*. In the first years of the twentieth century a Norwegian company, organized and managed by Jonas Lied, obtained large timber concessions from the Tsarist Government, and based its plans on transporting this timber down the Yenisei and Ob' and through the Kara Sea to Europe. Fridtjof Nansen accepted their invitation to sail with them on one journey aboard the steamship *Correct* in 1913, and his companion Jonas Lied delivered a paper to your Society.[1] Nansen stated in his book, 'Siberia, the Land of the Future,' that he was fully convinced of the possibility of commercial navigation in the western half of the Arctic Ocean.

After the Revolution the Soviet Government decided to organize the enterprise on a larger scale, providing it, as they were in a position to do, with large State funds. Not until 1932 was the North-East Passage successfully circumnavigated in one summer. It was the ice-cutter *Sibiriakoff* under Schmidt which concluded this journey from west to east. Since then at least one trip was made each year, until in 1936 fourteen vessels completed the whole route from east to west and west to east alternatively all in one summer. The Northern Sea Route Administration has meanwhile littered the coastline and the ocean with polar stations. There are fifty-seven of them now, all along the shore, and on islands in the Kara and East Siberian Seas. They are equipped with wireless, engaged in meteorological observation, as well as in hydrographic, geological, and biological exploration, and send regular reports on the weather conditions to the centre at Dickson four times a day; from there they are broadcast to Moscow and the most important weather bureaux of Europe. Two hundred weather and wireless stations further inland support them. Their work has given most valuable assistance to the development of the route. Forecasts as well as day-to-day observations provide navigators with valuable data as to ice formation, wind strength and direction, and thereby save them much time which would otherwise be wasted in planless wandering about in the drifting ice-floes.

There are mostly young people working on these stations, men and women of great courage and scientific zeal, who look upon their work as a national mission through the fulfilment of which they can contribute to the wealth of their country. I believe I can say that I have found among them the most sympathetic types of Russia's youth, strong, healthy, altruistic, with great faith in their work and ready to sacrifice for it, if necessary, their own comfort and welfare and even their lives.

Navigation is further assisted by a fleet of aeroplanes engaged in reconnaissance along the route. Taking off from bases along the shore, they reconnoitre a comparatively large area around and ahead of each caravan,

[1] Dr. F. Nansen and Jonas Lied, "The Sea Route to Siberia," *Geogr. J.* 43 (1914) 481–500.

draw maps of ice formation which, upon their return, they drop by parachute to the captains of the ice-breakers. Based upon their advice and the weather forecasts supplied by the polar stations, routes are then mapped out aboard ship, taking into account all factors which make for favourable navigation in these regions. The ice-breakers in use at present are mostly out of date. The largest of them, the *Yermak*, was built in Newcastle in 1899; others are the *Krassin* (famous for its rescue of the *Italia*), the *Lenin* and *Rusanov*. None of them can stay away from their fuel bases for more than twenty-five days. They have to return several times during one season to coal. This coming spring and in the following summer four new ice-breakers are to be put into service They will be of 12,000 tons, have 10,000 horse-power Diesel electric engines, and will carry two aeroplanes each, so as to be more or less independent of the ice-watch which coastal aircraft are now carrying out for them. I shall deal with the problem of refuelling *en route* at a later stage.

Up to now timber has been the main cargo. The Kara Sea expedition for five or six years has been a regular feature in international timber trade. Last summer more than forty vessels were engaged in it, and have brought almost seventy thousand standards of Siberian pine wood to Europe. Up to now the Soviet Government have not chartered foreign ships for the journey beyond the Yenisei. They still regard this as a mixture of trade and exploration and do not want to risk the loss of foreign vessels on that part of the northern sea route. Soviet ships however have come from Vladivostok to London and from Murmansk to Russia's far eastern ports. They carry equipment, food, clothing, and passengers to and from the polar stations, and also a certain amount of useful cargo between the mouths of the rivers.

Ports have been constructed on the Ob', Yenisei, and Lena. On the Ob', Novi Port has become a settlement for timber workers, who carry on work in the sawmills throughout the winter and help in the loading of foreign vessels during the navigation season. Port Tiksi is the clearing house for the Lena district. The largest of the towns in the far north of Siberia is Port Igarka on the Yenisei at lat. 67° 27′ N. At the time when I visited it it had a population of fourteen thousand men, women, and children (two thousand children!). Life does not differ fundamentally from that in other new Soviet settlements, so many of which have sprung up under the impatient command of the Five Year Plans of industrialization since 1929. It is built entirely of timber; the houses reminded me very much of Tyrolean and Swiss cottages. They are one- and two-storey buildings, providing good shelter against the hardships of the climate and even some comfort for their inhabitants. But timber is not only used for houses: all the roads are also built of this material. The short duration of the warm period and the scarcity of snow in the winter prevent the soil in these latitudes from thawing completely, even in summer. Only a thin surface of from 5 to 8 feet thaws in July and August. Underneath is a layer of permanent ice and frozen earth down to 60 feet. The rain of the summer months is not absorbed into the subsoil, and the surface of the tundra is turned into marsh and swamp. Igarka is built on such ground. A few of the older houses, those which have been put up four or five years ago, bear witness to the difficulty of building on such foundations. Some of

The streets of Port Igarka

Building a timber road in Port Igarka

Native students at school at a cultural base

A subterranean hothouse

them have sunk in at one side or the other within a short time after they were put up. The heat emanating from the huge brick stoves thawed the foundations. A different method is now applied. It consists of leaving a small space open between the floor of the rooms and the soil to allow the air to circulate freely underneath. The roads are really floating timber parquets; large logs are laid across the tundra, spaces between them filled up with sawdust, and a layer of well-polished beams is nailed across on top. Horse-carts, automobiles, trucks, and automatic timber carriers run about cheerfully on these streets. There is a theatre visited by flying companies from the Moscow Opera and other Russian art institutes; a cinema shows modern sound films; children go to school, youngsters have dancing lessons in their social clubs, and when I was there in August British sailors and Russian workers had a football match on the market square, which unfortunately ended with defeat for the British team. It had only been put together *ad hoc*, whereas the Russians are well trained.

Work goes on normally in this Arctic town all the year round. Even at temperatures of −40° C. the factories keep on cutting timber; it is rafted down the river during the summer. Only when the thermometer falls below −65° C. is work interrupted. This happens very rarely. The Arctic winter is not the coldest on the earth. Temperatures of −35° C. are usually the minimum, and such temperatures are not unusual even in the temperate regions of Russia, in the Ukraine and Southern Siberia, where we have seen large industries at work for many years. During the polar night the town is floodlit. Igarka cut up 500,000 trees for export last summer. That number would be sufficient to line both sides of a road from London to Baghdad and let motorists travel on it in continuous shade. Still, 500,000 trees are only 1 per cent. of what could be cut in Siberia each year without ever necessitating artificial re-afforestation. The natural annual growth is estimated at 50 million trees. The workers in Igarka are very keen on statistics, as are most people in Soviet Russia to-day. They were tremendously pleased when I worked out for them how much 50 million trees really are. If you were to lay them out in a straight line two by two, they would build a footbridge from the earth to the moon, I said. "And to think we could do that each year," one of them exclaimed proudly. "That shows you how rich we are."

The organization of the mills is on very modern lines. Up-to-date machinery has been brought from Sweden. Workers were trained in Archangel. At the present time no more foreign engineers are employed in the Far North. I had heard very much about the timber camps of Siberia five or six years ago, when Russia started exporting at lower prices than Canada or Finland. Newspapers at that time wrote much about forced labour. I cannot say what conditions were then. I found in Igarka that of the fourteen thousand inhabitants four thousand were exiled kulaks, formerly rich peasants who resisted the collectivization of their farms, either by actively sabotaging the work of the Collective or by resisting taxation, which was particularly high for private enterprise. Now they are paid normal wages for their work in Igarka, and outwardly can hardly be distinguished from the free workers. They live door to door with them. There are no guards; none are needed. The nearest railway station is almost 1500 miles away up the river. North

of the town extends the endless tundra. Down to the south the Siberian forests present a safer guard against escape than any prison wall. Their children are rapidly assimilated to the new society. They go to school with those of the free workers, and when they reach the age of eighteen are given all political rights and allowed to join even the Communist organizations, which is a privilege in Russia. The kulaks themselves are restored to their civil rights and given passports if, after a number of years, the authorities decide that they have worked well, have shown interest in factory production, and on the whole have proved themselves to be "dekulakized."

The port of Igarka provides good shelter against the river, which at that place is already 5 miles wide. A side arm of the Yenisei, separated from the main bed by a sausage-shaped island, is wide and deep enough to accommodate anything up to fifty sea-going steamers. The quay can at present only accommodate six to eight ships for loading. Up to 1936 it was torn away each year by the spring floods when the ice started moving. During the last winter however a permanent quay has been constructed, strong enough to resist the heaviest ice pressure. When more than eight ships come into harbour at a time the surplus is moored in the midst of the Yenisei's side arm, and loading proceeds in rather difficult conditions from barges, which take the timber from the yard out to the ships. It is curious to think of Igarka as a seaport. It lies 400 miles up the river. The captain of the British tramp ship with whom I travelled further north said it was as if Atlantic freight could be taken up the Elbe right into Czechoslovakia instead of having to be unloaded at Hamburg. Pilots have to guide foreign vessels up and down the whole of this distance from the sea. The Yenisei is 40 miles wide at its mouth. Many islands are scattered about in its bed, and channels deep enough for sea-going vessels have to be picked out very carefully. Navigation signals are put up along the shore, but no pilot risks going on during the few hours of darkness that constitute the night in these latitudes in August. We had to stop from midnight till about two in the morning, and the journey from Igarka to the Kara Sea took us four days.

Norilsk, the mining centre, and Dudinka, which will be its harbour, lie 120 miles further north than Igarka. At the moment, Norilsk is being built and the coal mines worked entirely by convicts. There were only three political prisoners there. The rest were criminals, murderers, thieves, procurers, and, just as I left, two hundred women convicts were brought down on barges to work in the kitchens, power-station, and in the houses. Coal lies fairly near the surface, but a thin layer of ice has to be cut through to reach it. Thin white fissures in the glossy black face of the coal indicate that all moisture freezes, even in the mines. The convicts are also paid wages and within the camp live a normal life. Much is done to imbue them too with the pioneering spirit. Banners with slogans are put up everywhere and large boards giving the names of different workers and the figures of their daily production are meant to stimulate a spirit of sporting competition among the convicts. No one can pretend that their life is rosy. Norilsk lies further north than the northernmost tip of Alaska. To reach the mines during summer one has to go down the Yenisei, along the west coast of the Taimir Peninsula, through the Kara Sea, then up the river Pyasina through Lake Pyasina, and

Port Igarka

Port Igarka

Artists from the Moscow State Opera on a flying tour in the Arctic

The air base at Port Igarka

the Norilka river as far as Valiok: a journey of 1400 miles. It can only be made once a year during July and August. In winter-time transport is possible only by reindeer sledges and dog-teams. For this reason a railway is now being built to link Norilsk to Dudinka, the distance overland being only 70 miles. The laying of tracks on this ground presented difficult problems to the engineers. The greater part of the line was completed at the time when I visited it, and the builders, with their usual Soviet optimism, assured me that it would soon be ready. The Norilsk mines are very rich in nickel, and as this is one of the few metals in which the Soviet Union is rather poor, the great expenditure involved in running the mines and the railway in such an outlying district will probably be justified, especially in view of the military importance of that metal. Norilsk coal will also be used for river craft on the Yenisei and for part of the shipping on the Northern Sea Route. A fuel base is being erected on Dickson Island, where facilities for bunkering are already provided. This will increase the radius of action of most ships and allow them to bring in more goods than at present, when they have to take coal at Murmansk in sufficient quantities for both outward and homeward journeys.

The town, of which I said that it did not yet exist when I saw it, is Nordvik. It lies at the point on the coast of Yakutia where the meridian of Hongkong crosses the parallel of central Greenland, at the mouth of the Khatanga river. The district is rich in salt, coal is found on open ground, and, as at Baku, oil was found next to the salt. Last summer five ships were sent out from Archangel to bring six hundred workers, houses all ready to be put up the day after unloading, mining machinery, food, furniture, radio equipment, hospital appliances, to Nordvik—in short, everything that a young town needs to deserve the name of a city. It was a romantic enterprise; the Russians called it a fleet of Noah's Arks. They hope to mine 180,000 tons of salt a year by 1938. This would be of great importance for the fisheries of Northern Siberia. At the present time salt for canning has to be brought all the way from the Black Sea, either through the Mediterranean, the Atlantic, the Panama Canal, across the Pacific to the Far East and on railways and rivers up to the north, or over the Trans-Siberian railway, which is already so heavily over-burdened through rapid industrialization and military development in the far eastern provinces. The oil of Nordvik, so the Russians hope, will be refined on the spot and used for refuelling ships half-way on the Northern Sea Route.

One of the main problems in the scheme of settling a sufficient number of Europeans in these outlying districts is the provision of fresh food for them. At a later stage the Soviet hope to educate the natives so that they can run industry and transport in their country themselves. They are used to living on raw meat and frozen fish; but Ukrainians, White Russians, and Southern Siberians refuse such a menu. Who could blame them for it? To prevent scurvy their meals of tinned meat, fish, potatoes, and macaroni have to be supplemented by fresh vegetables and fruit. Much energy and expenditure is therefore devoted to agricultural experiments in the polar region. Nothing except moss and lichens will grow on the polar islands and along the coast. But further inland, below the sixty-eighth degree, radishes, cabbages, and

onions have already been made to grow in the open air. Igarka has a large State farm, which supplies vegetables, not only to the town itself, but also to the polar stations. Its stables give shelter to 350 head of cattle, 200 pigs, 250 rabbits, and over 100 horses. The sowing area is still only a few hundred acres in extent. But the fact that most of the products, including potatoes and onions, grow already freely outside the experimental nursery suggests that the cultivation of more land is only a matter of time and of a sufficient supply of human labour. The hothouses produce tomatoes, cucumbers, and asparagus. Strawberries and apples have just been grown for the first time in the experimental fields. At the polar stations themselves cucumbers and salad are grown underneath the ice. Chambers well isolated against the cold are built of wood and fur underneath the ice. They are heated electrically and the plants get their light from 300-candle-power bulbs. The current is produced by windmills, so that one is justified in saying that nowadays even Arctic storms grow green vegetables. Experiments with wheat, oats, and barley are also being made above the Arctic circle and sub-Arctic regions. These experiments have proved successful so far on the Kola Peninsula, where the climate profits from the Gulf Stream. On the State farm in Igarka, which the Russians proudly christened "Transarctica," wheat stood only a foot high last September. But the method of "Jacovization" evolved by scientists in the Agricultural Institute at Leningrad promises better results for the future. The seeds are partly saturated with water in advance, and as soon as germination has set in they are kept at a constant temperature of between 5–30° Celsius for a certain number of days and then planted normally. Their whole life cycle is speeded up and strengthened. On some experimental stations, which however I did not see, winter oats are said to have been planted in spring and to have ripened earlier than ordinary spring-sown oats. Their yield per hectare was even 30 per cent. higher, according to Bogomolkin, the head of the Arctic Agricultural Institute.

The problems which the "farming battalion of the polar army" have set themselves the task of solving are the following: First, to drive up grain cultivation as near as possible to the polar regions in order to have a food base at a comparatively short distance from the actual Arctic colony and thereby to save transport costs. Secondly, to evolve typical specimens of plants with short growing seasons and the power to resist occasional mid-August frosts. Thirdly, to develop methods by which the ripened plants can be kept fresh over a period of two years. This is particularly important, because most of the plants and cereals are only ready for harvest at a time when the navigation season is already drawing to its close. It would be no use getting crops in October when the northern parts of the river are covering themselves with ice and shipping in the Polar Sea itself is liable to be stopped at any moment by premature winter. The crops would lose their vitamins, putrify or send out shoots during the winter. They have to be kept intact for over a year, and be shipped off safely as soon as the navigation season starts the following summer. The method which Bogomolkin said has proved successful in 80 per cent. of all cases is this: large boxes are constructed in which the plants lie asleep in carbon monoxide. Experiments are now being made with X-ray chambers as storage rooms for Arctic farms, as they also arrest the life of these

plants. The greatest asset which compensates agricultural workers in the Far North for the poor quality of the ground, the short duration of the warm season and occasional midsummer frosts, is the abundance of light during the polar summer. It lasts continuously for twenty-four hours for a period of two months even in the lower regions. It has been found that grass, for instance, grows ten times as fast in the Arctic as in our latitudes. The cabbages in Igarka have larger leaves than those we see round London.

No one, of course, believes that Arctic agriculture is a paying commercial proposition. But once it has been accepted as worth while to open up the north for mining, timber-cutting, navigation, and aviation, the provision of local settlements with fresh fruit, and the assurance that the health of the inhabitants is safeguarded and that transport breakdowns through natural catastrophes will not expose them to starvation, make the cost of producing tomatoes and cucumbers in the tundra a matter of secondary importance. The people in "Transarctica" worked out for me that even double the present price of production would still be cheaper than the transport of the produce by aeroplane from Southern Russia. One of the kulaks thought the whole thing ridiculous. He said, " If you put a University professor behind each potato to make it grow, you can probably raise them even at the North Pole." But although the optimism and complete lack of respect for natural difficulties which is so characteristic of the Russians to-day does at times look a little naïve, their experiments and achievements in the Far North certainly contribute useful knowledge to mankind.

The whole scheme depends of course to a large extent on the development of aviation. Land travel across the roadless forests and swamps in the north is restricted to reindeer and dog driving, and only possible in winter. Regular air services however are now in operation throughout the greater part of the year along the main Siberian rivers. There are bases on the railway line at Omsk for the Ob' and Irtish, at Krasnoyarsk for the Yenisei, and Irkutsk and Yakutsk for the Lena. Hydroplanes only are used, for there are no landing-grounds. Planes fly above the rivers where they can come down at any time, and above the sea. They have skis as well as floats to enable them to land on the ice. Passenger transport is not the only service which aviation renders in the Arctic. Ice-watch pilots guide the ice-breakers. They map unexplored territory, study the extent and quality of the forests, and assist the sealing fleets in their search for animals. The Russians believe that the Arctic will be one of the most important highways of international air traffic in the future. Communication between the most important centres of the world, which are all in the northern hemisphere, like New York, Paris, London, Moscow, Tokio and Peking, is in fact shorter if one flies over and across the top of the world than around its waist. The Russians insist that in a few years' time we shall fly from London to Tokio not across southern Europe, India, and China, but over Scandinavia and Arctic Siberia. They themselves will start an air line from Moscow to San Francisco along their Arctic coast next summer. Later on they intend to fly across the Pole. This is certainly music of the future. As long as the stratosphere is not fully explored, the lack of landing facilities, the violent Arctic storms, will probably constitute insurmountable difficulties to aviation, on normal lines at least. But there is nothing to prevent

successful flights, especially in summer, when pilots enjoy the advantages of continuous light, and of a new network of refuelling bases, meteorological stations and wireless services along the Northern Sea Route. I have flown for a total of about a hundred hours in Arctic Siberia myself, and found that it does not expose you to unbearable hardships. The planes are not comfortable, since they are used for cargo as well as passengers as occasion demands. They have no seats; you have to huddle on the floor on a bunch of bearskin and dog furs. But the bases are well equipped. You get all the food you want as well as sleeping accommodation. Whenever fog brews up the pilots sit down on the rivers and wait for clearer weather. They do not risk blind flying yet, because forced landings in the tundra would be too dangerous. As soon as the mapping of the territories is completed and a narrower net of stations and settlements developed, these disadvantages will also disappear. Although they speak of dropping a party of observers, of wireless equipment, food supplies and building material by parachute, on the North Pole itself, I prefer to reserve recommendations for holiday trips across the Pole until a later date.

Before concluding I would like to say a few words about the natives of Arctic Asia. They are no doubt the natural trustees of that area. They have been used to life there for centuries. They know the tundra and how man has to live there. In the last fifty years their number has rapidly decreased. But education, instruction in hygiene and modern sanitation, which is at present brought to them, has already arrested the decrease of birth rate in a number of tribes, and it is hoped in the future that their numbers will again increase. With their usual haste and zeal the Soviets first overdid their good work for them. They brought youngsters directly to Europe and made them study in Leningrad. Some of them died of consumption; others languished miserably on our diet of cooked meats and vegetables. They were used to the germ-free air of the Arctic, and unlike us were not immune against the many infectious diseases of town life. A different method is adopted now. Teachers go out to the tribes, travel with them for several winters to win their confidence, show them how to look after the health of their reindeer herds, compete successfully as veterinary surgeons with their *shamans*, and sooner or later ask them to leave their children in the local schools. Cultural centres in considerable numbers have been constructed in the main trading bases, where natives call regularly to sell their furs and buy provisions. There the children are educated, taught to read and write in new alphabets specially constructed for their languages; but at the same time nothing is done which would deprive them of their natural skill and ability as inhabitants of the north. They are shown the use of motor boats and metal traps, both of which help them to increase their profits from hunting and fishing. They are paid fixed prices for their products and only the State is permitted to trade with them. The sale of alcohol has been forbidden. They are exempt from taxation and from service in the army. The young scientists who go out to them to carry on the work of enlightenment and education are very much imbued with the spirit of the white man's burden. They reminded me very much of missionaries—red missionaries, if you like. The philosophy which they teach is very different from ours, but I was surprised to find how

Christian in the best sense of the word their outlook is. No doubt Lenin's principle that each national minority in Russia should be regarded as the natural trustee of the region in which it lives is not the only motive for what the Russians are doing to improve the standard of life of the native population of the Arctic. There is a good and sound economic background for this policy. It is a fact that in the long run these natives will provide a better personnel for any kind of work that is carried on in the north than Europeans.

I would be deviating from my subject, the economic development of the Soviet North, if I entered too far into the field of political activity in that region. I may be permitted however to say just this much about the methods of propaganda and what the Russians like to call cultural work among these tribes. It is their policy not to let Europeans remain too much in the foreground as far as official contact with the natives is concerned. The Institute of the Peoples of the North in Leningrad is constantly turning out cadres of teachers, economists, and technicians for the North, who are taken from among their own students. Whenever it is possible, the autonomous administration of certain tribal districts is left completely in the hands of native Soviets, and it is quite easy for the Russians to make the natives accept the idea of Soviets as a form of local government because fundamentally they differ very little from the indigenous form of tribal councils. There is very little room for socialization among nomads. Reindeer herds constitute the only form of ownership in means of production. The tundra is there for everybody, and hunting and fishing is a matter of personal productive activity. But of course the Revolution does not halt at the fringe of the tundra. Attempts are made—how far they are successful I cannot tell—to collectivize the herds. There are poor and rich even among the Samoyeds and Tungus, the Chukchee and the Yakuts in the polar regions of Asia. Some have reindeer herds of 25 or 50 head of cattle, others own as many as 3000. These employ reindeerless second sons of other herdsmen and pay them with a number of reindeer each year. Here the political intention of socialization goes hand in hand with the tendency to improve the economic conditions by division of labour. Native Soviets decide in some cases that the whole herds should be put together, and that only a number of herdsmen should travel north with them when the mosquitoes infest the southern parts of the Arctic. The rest of the families devote themselves to fishing. Children are either sent to the cultural bases or kept together in a number of tents, whereas the women are delegated to mend the nets and sew the clothes for the men of the whole tribe. During the summer, also, a kind of roving grocery shop, that is to say, a motor-boat, carrying provisions and clothes, is sent down the rivers so that the natives need not travel to the trading centres in large numbers, but can simply pitch their tents on the banks of the river and wave the passing boat to the shore whenever they want to barter goods. It is an Arctic equivalent of our familiar "Stop me and buy one." Women who keep their children clean and follow the advice of the medical officers who travel about to visit the tribes are given premiums to flatter their pride and hold them up as models to others. One morning, when we made a forced landing on the Khatanga river and had to wait for some hours for the fog to clear away, I spent some time in a tent

with a Dolgan family. I was rather surprised to see the mother working on a hand sewing-machine while she sat on her bed of reindeer furs. " I got it as a premium," she said, "because I wash my children at least once a week." She, too, confessed that she had risked the life of one of her boys by sending him to school. " If he gets through alive," she said, "we shall send the rest as well." I asked her what she thought of all these modern things, and inquired whether she knew what a motor car was. She said, "That is quite simple, just an aeroplane like yours outside, only that it has no wings and keeps on the ground." These Arctic natives become acquainted with our civilization in a different way from us. The latest vehicles get to them first.

A question that most of us would ask ourselves when we hear how much money and human energy is being devoted to this enterprise of colonizing the Arctic—the Northern Sea Route Administration employs an army of forty thousand people in the struggle against the Arctic—is whether such expenditure is justified or profitable. It would be no use for me to give you the figures in roubles and kopecks, or even to try to translate them into pounds, shillings and pence. The official budget of Russia's North Asia Company—they like to call it that in parallel to the East India Company—was £250,000,000 last year. We look upon the problem from quite a different point of view. In Russia as it is to-day the whole productive activity of the nation is regulated and controlled under a comprehensive economic plan. If certain spheres of that Arctic enterprise were run at a loss, or even if the whole scheme could not be regarded as profitable, it would, from the Russian point of view, still be justified as long as it increased the wealth of the nation as a whole or repaired some of its geographical deficiencies. I am sure that very much of what is being done in Russia to-day is undertaken for military and strategical reasons. They do believe that they are continuously exposed to the danger of attack. If the question of transport across and through their vast territories in Asia could be solved, if not wholly at least in part, by the opening up of the Northern Sea Route, it would in their eyes already be sufficient excuse for considerable work. They reckon that in the case of simultaneous attack, when the European as well as Far Eastern ports of the Soviet Union might be blockaded and the Trans-Siberian railway overburdened through military transports, facilities for the shipping of war material and food supplies through the Arctic Ocean and down the great Siberian rivers would prove a great asset to the country. Moreover they think that in such a case they could also send ships through the Bering Straits and along the west coast of America to bring supplies from the United States. Such a route would be almost unassailable by an enemy, if only because the assistance which navigation needs in these regions would only be given by the Russian system of polar stations. Personally I think that, apart from these strategical motives, the work spent on exploring and developing the Arctic will prove profitable and valuable to Russia and the world in general in the long run. And from this point of view I think that we should welcome the work which they are doing in the polar regions.

DISCUSSION

Before the paper the CHAIRMAN (Admiral Sir WILLIAM GOODENOUGH) said: Of all the activities in which we indulge in this Society none is more important or more interesting than that which deals with what one may call the extension of the area of the habitable globe. That is what we are going to hear about to-night from Mr. Smolka. Mr. Smolka is himself a Viennese. He is going to tell us, from personal experience, of a visit to more than one town, one a fairly big town, in the Soviet Arctic; to tell us of the methods of developing the country, of the way in which the people live, and all about them.

There are certain people here whom I shall ask to speak afterwards, but the discussion is not confined to them. I shall be glad if those who wish to ask questions or to make remarks will do so. There is one remark I would make, and I would strengthen it by saying that I have a letter on the subject from the President, and that is that political affairs are not our business; we discuss here geographical and economic problems.

Mr. Smolka then read the paper printed above, and a discussion followed

The CHAIRMAN: After that most suggestive and stimulating lecture I will first call on one who knows the Arctic far from Russia, and that is the Bishop of the Arctic whose diocese is in Canada.

The BISHOP OF THE ARCTIC: It is not often that I am privileged to hear someone else speak on the Arctic, but I have spent here one of the pleasantest afternoons of my life. I therefore would like, first of all, to express my very deep appreciation of all the information the speaker has given us in connection with Arctic Russia.

Several things impressed me, among them the similarities and the dissimilarities. I noticed that our speaker did not emphasize certain things that I think might have been of interest to you. He only casually mentioned the mosquito. One day at Aklavik I was speaking to a very splendid young Englishman. It was a gorgeous day, one of those uncommon days in the Arctic, when everything is still and quiet, and the Mackenzie river was like a mirror. I said to him: "Grand weather, Jimmy," whereupon he replied: "Yes, the Arctic would be ideal for a summer resort if it were not for those something, something mosquitoes." I notice, with pleasure, that they are not confined to Arctic Canada, but that they also find their way to the Russian Arctic.

One of the things that impressed me was the problem the Russians seem to have in connection with their houses in the Arctic. We saw a picture of a street with a house which had a not exactly perpendicular wall. We have overcome that difficulty at the mouth of the Mackenzie river. It is a problem that has confronted us for years, but I think we have now solved it as far as our part of the world is concerned. You will remember that the part of Russia about which we have heard is 400 miles south of the Arctic Ocean, and thereby hangs a tale, for when you go 400 miles up a river south of the Arctic Ocean, climatic conditions are very different from what they would be were the Arctic Ocean at your door. I understood the lecturer to say that the soil in Arctic Russia thawed for about 6 feet down; at Aklavik at the mouth of the Mackenzie river, 120 miles north of the Arctic Circle, where we have just put up a large school accommodating 150 children and staff and are now putting up, almost completely, a hospital with 48 beds, and all the paraphernalia that goes therewith, we were faced with the very problem to which the lecturer drew attention. Our soil does not thaw to more than 12 inches from the surface; from 10–12 inches down you come to the permanent frost-line. We tried to put beams on that frost-line but that did not work. Eventually our master carpenter solved the problem by

digging holes 5 feet below the permanent frost-line and then putting in posts. All the king's horses and all the king's men cannot shift a house built thus. Our school with a cubic capacity of roughly a quarter of a million cubic feet, placed entirely on posts sunk 5 feet below the frost-line, has not moved one-sixteenth of an inch. That is one point that interested me, and it shows that even in dealing with land away north of the Arctic Circle it is not sufficient to know just that one fact if you are going to form a proper judgment in connection with the place.

The other point that interested me is that while a great area of Russia goes north of the Arctic Circle, it also goes so far north that the area beyond the Arctic Circle, which is still far from the Arctic Ocean, can be developed. The Dominion Government of Canada is giving a great deal of time and thought to the question of Arctic Canada. It, like the Russian Government, has established wireless stations across the whole of Canada, but some considerable distance apart. We hope gradually to develop, perhaps in connection with the trading companies and the Missions, small-powered private wireless stations to connect with these larger ones and thus we shall be able to set up communication. I can however see no possible chance of Canada emulating Russia in any way comparable to what we have heard to-night.

If any of you are interested in Arctic Canada I would beg of you to study your map and the climatic conditions. I myself discovered a white traveller north of the Arctic Circle at the mouth of the Thunder river flowing into the Mackenzie, and he was growing most excellent vegetables there; but I must say I would have to be a Russian optimist if I ever thought we should develop that scheme in other parts of Arctic Canada. He is at a particularly opportune point. He sells his cabbages, carrots, turnips, and beets north of the Arctic Circle and they are a great boon. But most of Arctic Canada suffers because the land is either surrounded by water or very near to water. If you visualize the Dominion of Canada you will not forget that the great inland sea, the Hudson Bay, is there. That has a very chilling effect on the whole Arctic right away south. So that we have this mystery in Arctic Canada: north of the Arctic Circle, where our Aklavik Mission is and where our new hospital and school are, there are trees 40 feet high; and yet on the other side where I was a missionary with an area of 211,000 square miles, an area roughly five times the size of England, there is not a single tree, nothing but creeping willow. That is to say, it is possible to go some 600 miles south of the Arctic Circle on the east side of Hudson Bay before coming to a tree.

So the two countries are very different in certain ways although there are many similarities. Of course the aeroplane in Arctic Canada is solving the problem in a most wonderful way. I myself travelled 10,000 miles through the western section of my diocese last summer, and of that 4759 miles were covered by air. It took me three months to do that, and by the other means of transport it would have taken at least two years and I should still be there now instead of having had the opportunity of listening to a most delightful lecture.

Mr. B. E. M. GOLDMAN: I should only like to add to the remarks of Mr. Smolka in a very small measure. First of all, I wish to express thanks to him for having shown me so much that I did not see when I was in that part of the world. I went to Port Igarka in 1932 when there were only one or two aeroplanes on the whole of the Arctic coast, and the trading convoy only consisted of some thirteen or fourteen ships; so that within four years the number of aeroplanes has increased enormously and also the number of ships, the export of timber showing a fourfold increase. So far as I can make out, the actual conditions in Igarka are very much the same as when I was there. There are not very many

more people; and the number of prisoners, which is also a subject of interest, remains more or less the same.

There are one or two notable differences. When I was in the country there were no cars or lorries in use; the only mechanical vehicle was a timber transporter. With regard to the football match, when I was at Igarka in 1932 I also took part in a football match and the difficulties were added to considerably by the fact that the football was only about the size of a tennis ball. I was glad to see from Mr. Smolka's photograph that that difficulty has now been overcome. I may say that we were probably even worse beaten than the team last year.

With regard to the growing of vegetables and wheat in the north, very little had actually been done when I was there, though something was being done experimentally. I think the greatest source of pride was the chrysanthemum. I have heard since that the type of wheat which has been developed in the Northern Agricultural Institute is being used with success at over 10,000 feet in Northern India, where hitherto the growing of wheat has proved impossible. There is one question I would like to ask Mr. Smolka, and that is whether any constructive effort has been made in connection with the difficulty due to fog in the Kara Sea. When I was there we were absolutely immobilized for, I think, three days owing to fog in the Kara Sea, and of course the pilots in the region lose about nineteen days a month on account of fog, even during the navigation season.

Mr. SMOLKA: I think the region is now better charted.

The CHAIRMAN: I am glad to see Mr. Jonas Lied is with us and we should like to hear him.

Mr. JONAS LIED: I should like to ask Mr. Smolka whether the Soviet Government have taken any measures to increase transport through the Kara Sea, because unless it is possible to materially increase transport through that sea I do not think that the country can be fully developed. It would be interesting to know what Mr. Smolka has to say about it.

Mr. SMOLKA: The transport, as Mr. Goldman has just pointed out, has been increased considerably. In 1936, forty-five vessels got through, but up to now transport consists mainly in carrying timber from Siberia to Europe. It is hoped that in a given time there will be exchange between both Europe and Siberia.

Mr. JONAS LIED: It is almost twenty-three years since I had the privilege of addressing an audience of this Society on a subject similar to that dealt with by Mr. Smolka this afternoon, and that is the Kara Sea route which is so important for the development of Siberia. On that occasion Lord Curzon presided over the meeting and as I had a hazy recollection that he made reference to a suggestion of mine at the time in regard to the employment of wireless telegraphy and aeroplanes, I looked up the *Journal* of the Society and this is what I found. Lord Curzon, after expressing the hope that there was a certain future before the proposed new branch of trade flowing through the Kara Sea, said: "And what an interesting reflection it is that so rapid is the march of science nowadays, so closely is it allied to almost every branch of human activity that we are told that the development of this traffic in the future will be largely dependent, on the one hand, on the use of wireless telegraphy; on the other, of aeroplanes." Then he went on to recommend me to adhere to the respectable cargo steamer which I had used for the expedition that year. In my turn I may say that it is an interesting reflection that Mr. Smolka in his lecture, and also in his interesting articles in *The Times* a little while ago, actually had it suggested to him that potatoes may be grown at the North Pole if you put a university professor behind every one of them, and there was also a suggestion of the North Pole being used as a hopping-off place to parts of the world like New York, San

Francisco, Shanghai and Tokyo, places which have been despised by ambitious explorers for generations past. I think it is just as well that explorers like Peary, the Duke of Abruzzi, Nansen and Amundsen, who spent a great part of their lives in attaining the North Pole, are not here to hear that statement.

What I would particularly like to draw attention to is the use of the Kara Sea route, because I feel that the full development of Siberia without a proper use of the Kara Sea route is absolutely impossible. I understand that the Soviet Government intend to continue sending their steamers direct from Europe through the Kara Sea to the Ob' and the Yenisei. The trouble has always been to get steamers ready at the time when the ice season opens in the Kara Sea, but unfortunately that varies up to one month. When we had all our property confiscated by the Soviet Government in 1917 at the outbreak of the Revolution we had a scheme to erect a port on the western side of Novaya Zemlya, which is open all the year round, for steamers from Europe to discharge their goods there and load Siberian products, all of which we intended to transport through the Kara Sea by a fleet of ice-going tugs towing a string of barges. Unless the Soviet Government develop a scheme of that kind I do not think that they will make a success of transportation through the Kara Sea on commercial lines, and I suggest that this scheme should be adopted in order to develop the tremendous resources of that huge country.

The CHAIRMAN: I wish the President were here for this is a subject which he with his anthropological and ethnological knowledge would be able to comment on with great advantage to all of us.

I know I am expressing your views when I repeat what I said a few minutes ago that we have been greatly stimulated. The first reaction I have is one of a feeling of great encouragement at hearing of an immense effort being made. Different administrations act in different ways and have different methods of developing places for their people and increasing populations to go to. What one country may do, another may do in another direction.

As to its discussion here, there is no problem more geographical in its connection requiring solution, and with many other subjects this is the place for ventilation. So I come to this point. What are we doing? By we I mean this country. We do not move very rapidly in this country. I know very well when one is impatient of delay there are many who say: Oh, my dear fellow, you don't realize the difficulties. I ventured to write to *The Times* on this subject and I say again here: I know all the difficulties—the disinclination of people to move, the disinclination of Governments to receive people before all are certain they are advancing over safe ground. And I know that these difficulties are not insurmountable. If those travellers and explorers we have so often acclaimed in this Society, and whom we shall continue to acclaim, had only advanced when they were sure they were safe we should not have gone far. These men and women have gone prepared to make mistakes and to take risks, and it is in the sense of an explorer that this vital problem of finding room for an increasing population should be approached. I repeat what I have said before, that no explorer, no geographer, is doing his complete duty unless in his movements and in his mind he has before him some idea of human progress.

I regret very much that the lady who spoke to us on Canada three years ago, and who had hoped to have been with us this afternoon, cannot be here after all. Read in the address which she gave to us her opening sentence from George Trevelyan's 'History of England' about the first move to use part of this country for human habitation. I asked her if she had a message that I could give you, and she said: "Yes, tell them about individual effort." Individual effort has to be combined and collected together in some way. You

heard what the Bishop of the Arctic said. You have read what Canada is doing in the research about pitchblende. We should do all we can to develop the unoccupied portions of our countries.

I have a letter written by the Governor-General of Canada in which he says he is constantly pointing out the possibilities of development in Canada. Read what every Prime Minister of every dominion has said recently, that there is room for more people in their dominions; the Premier of New South Wales; the Prime Minister of Australia, each in turn has said the same thing. I am sorry Mr. William Teeling is not here to-day, but you can read what he says in his book 'Gods of To-morrow,' where he advocates that a large portion of Australia, 100 miles by 50 miles I think, should be leased from the Australian Government.

There is of course no end to what one could say on this subject. You saw that globe showing the flying routes of the future. Bear this in mind. I won't say the first, but one of the first people who thought of those routes was that young man who was drowned five years ago, whom we honour so greatly in this Society, Gino Watkins. He was one of the first to realize the possibility of Polar flights. When we know more about the stratosphere, the troposphere, and the atmosphere I have no doubt that something will happen.

Well, Mr. Smolka, time passes by. You have given us a most extraordinarily interesting afternoon. The size of this audience, far greater than we sometimes have in the afternoon, will, I think, convince you how interested we have been. I beg you, on our behalf and on behalf of the other Fellows of the Society, who will no doubt read with great interest your paper in the *Journal*, to accept our warm thanks. We offer you our encouragement to go on to search out and write about these problems and let us have the benefit of your conclusions.

THE POPULATION OF BENGAL, ITS DISTRIBUTION AND CHANGES: A CONTRIBUTION TO GEOGRAPHICAL METHOD. *A paper read at the Afternoon Meeting of the Society on 15 June 1936, by*

ARTHUR GEDDES, D. ÈS L. (MONTPELLIER), PH.D.

THE description and cartography of the distribution and of the changes of population in Bengal are the main concern of this paper, together with a detailed account of the methods employed in mapping. While the urban population is not neglected in this study, special emphasis is laid on the rural population which so vastly outnumbers that of the towns. In a previous work, written shortly after my return from Bengal, I indicated the geographical background of the great population changes of that land.[1] Here the population groups will be described as they occur, with brief comment on the geographical meaning of the demography as occasion demands and as a conclusion. The reverse method—beginning with the physical tracts (outlined in the work referred to) and following with the demography—would involve the danger of forcing the inhabitants, as it were, to fit into an imagined habitat on *a priori* grounds, instead of allowing the inhabitants themselves to reveal the environmental nature of their land and their contact with it.

India and Bengal. Comparisons of Density and Variation. Bengal's Slow Average Increase.—In 1931 the population of the Bengal Plain reached fifty millions. With its states of Tripura and Cooch Behar the province contained 51,087,000, or 50,370,000 excluding the hill country which constitutes most of Tripura and of the districts of Chittagong Hill Tracts and Darjeeling.[2] Those fifty millions upon the plain thus outnumber the people of any other province or state of India and contribute more than one-sixth of the total population of British India, and this in spite of the relatively small area of the province (83,000 square miles) and the further reduced area of the plain alone (73,000 square miles). The great western plateau presidency of Bombay, with double the area (150,000 square miles), has less than half the population (22,000,000). Even the United Provinces of Agra and Oudh, whose population almost equals that of Bengal, have a considerably larger area (112,000 square miles), most of it a plain. The density of the plain of Bengal averages close upon 700 per square mile, when towns are included, or 640 of rural population alone. These figures are comparable with the plain of Bihar, while the rice-growing areas of the south-western coastal plain of India and of its south-eastern deltas support a density similar to that of Eastern Bengal, which ranges from 900 to 1200 per square mile. The average density of India, including all types of density, from crowded ricelands to sparsely peopled

[1] Arthur Geddes, 'Au Pays de Tagore: la civilisation rurale du Bengale Occidental et ses facteurs géographiques,' Paris: Armand Colin, 1927; "The Regions of Bengal" (*Geography*, No. 85, vol. xv, Pt. 3, September 1929, p. 186).

[2] 'Census of India,' 1931, vol. v (Bengal). Part I (Report) by A. E. Porter, and Part II (Tables). Throughout the remainder of the paper no further references will be given for statistics which have been taken directly from this source, but references will be given for statistics based upon it but involving fresh calculation here.

steppe, approached 200 in 1931, and will have exceeded that figure before the census of 1941. Densities such as those of Bengal are in Europe only equalled in areas combining intensive agriculture with manufactures, and are only surpassed as averages for large areas when there is an immense urban population. Thus while Bengal has an area more than two-fifths as large again as that of England and Wales together, its population is little more than a quarter as large again. Such figures give Bengal a high place in numbers and density.

Compared with other provinces of India however Bengal is seen to be unfortunate measured by the figures by which a population's natural growth can be recorded and, with this, its health and well-being. The percentage of increase in Bengal from 1921 to 1931 was 7·3 (as compared with 2·8 in the previous decade), and it was lower than in any of the major provinces of India except the United Provinces. The increase of India as a whole was 10·6 per cent. from 1921 to 1931, though it was as little as 1·3 per cent. in the preceding decade when the influenza of 1919–1920 ravaged whole provinces. Even making allowance for the emigration of Bengalis into Assam by taking Bengal's "natural increase," this percentage (8·3) is still lower than that of India for the last decade.[1]

Urban and Rural Population.—The population of Bengal, as of India, is predominantly rural, the urban population nearing 3,700,000, a proportion of 7 per cent. urban to 93 per cent. rural, or 1 to 13 for the province. This shows a smaller urban percentage for Bengal than for India as a whole (10 per cent.), even although one-third of the population of Calcutta and of the towns near to it come from outside the province. The urban population is predominantly centred at Calcutta (1,200,000) or aligned on either bank of the Hooghly, opposite, above and below the city, some 450,000 being gathered on each bank.[2] This gives a total of two millions (2,100,000) for an almost continuous commercial, industrial, and suburban belt, forming a unity or conurbation of imperial importance which deserves a name, and might well be called "Hooghlyside," the name I propose henceforward to use. Hooghlyside accounts for over two-thirds of the urban population of Bengal; but when the proportion of males to females (2 to 1) is compared with that of all born outside the province (as much as 1 to 3)—most of these being men who will return home—there emerge three striking facts: (1) the high labour output implied, (2) the shifting nature of industrial and commercial life, and also (3) the disintegration of social life involved.

Dacca (140,000), in the east, is a regional capital of character and interest. After Dacca come the divisional or district headquarters and other river and railway centres, some of which are of historic and some of modern foundation, with populations of from 60,000 to 20,000, 15,000 or 10,000. The remaining urban population is chiefly made up of "towns" below 10,000, whose small size is a reminder of the predominantly rural activity of the population they serve.

Outline of Distribution and Change.—The tracts of greater and lesser density may now be outlined, and the changes they show then compared. These changes are known from the first Census of 1872, or more exactly from that

[1] 'Census of India,' 1931, vol. i (India), Pt. I.

[2] Compiled from 'Census' (Bengal), 1931, Pt. II, Prov. Table I.

of 1881, but contemporary estimates of change allow us to form a fairly correct idea of densities from before the middle of last century, when the arrest of population in Central Bengal set in with an epidemic of malaria. Before discussing the most detailed map of density prepared here, that simplified from it may first be considered so as rapidly to obtain a general though accurate view of the facts (Fig. 1). After discussion of the distributions portrayed on the detailed maps, which form the essential contribution of this chapter, we

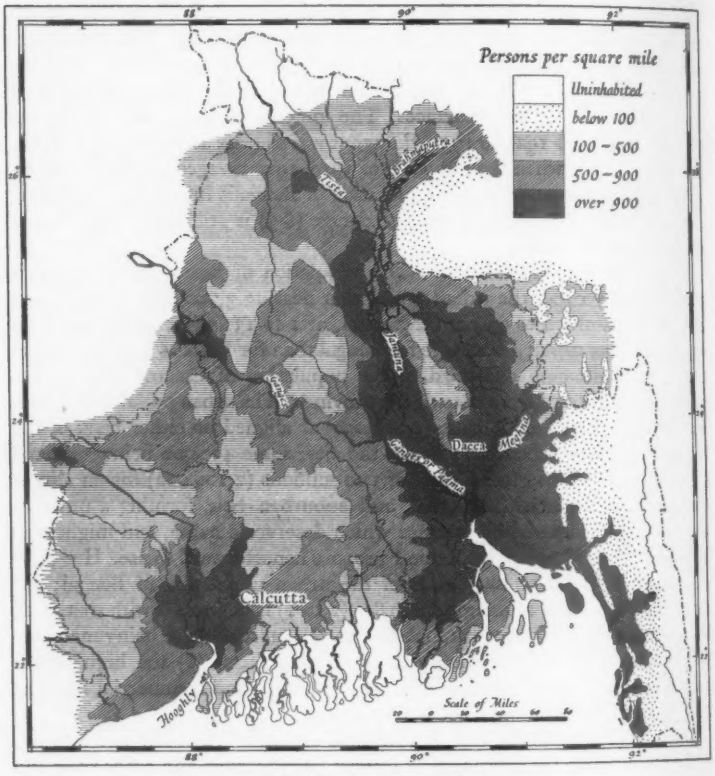


Fig. 1. Density of rural population, 1931

shall conclude by touching upon the rate and manner in which different territorial populations have increased or decreased, decennially, annually, or seasonally, because of the light thus thrown upon the conditions of the people and their environment.

Fig. 1 shows four densities selected to give a convenient range and to correspond with the more important types and conditions. To make it, the selected isopleths were simplified enough to emphasize the unity of the main tracts (sufficiently too to allow of reduction to 1/10 in reproduction)

without quite effacing the riverside alignment of population which gives a characteristic pattern to the delta with the sinuosity of the isopleths. Within the fringe of very sparsely peopled tracts of jungle country to north and east of the plain and the uninhabited jungle to south, there emerge clearly: (1) the almost continuous belt of country on the west having low densities (below 500),[1] with two triangular areas situated west-centrally, (2) the medium densities of much of the west, north, and centre, stretching to (3) the high densities of over 900 occupying the east. It is interesting still further to simplify the fourfold comparison thus offered by considering only two grades at a time, one above and one below a chosen figure, for this emphasizes different correlations of population with habitat. A comparison of all densities of over 500 over the whole plain would indicate how rarely the higher densities are found on the Old Alluvium. Further inquiry would show that the exceptions rarely exceed 600 to the square mile, and these, most frequently, only increased from 1921 to 1931. Except for areas of recent and uncompleted colonization near the foot of the Himalayas and in the Sunderbans, there are on the New Alluvium only two great tracts having a density lower than 500, but these two are important. They are triangles, each arranged with the apex to the head of the Ganges delta. The larger tract covers most of Central Bengal, from its apex near the head of the delta 160 miles south to its south-west angle close to Calcutta, whence its base stretches 80 miles east-north-east, its north-eastern side lying 15 to 40 miles south-west of the Ganges-Padma. The smaller tract, less clearly triangular in shape, turns a blunted angle to the old entrances of the left or north bank distributaries of the Ganges-Padma, where these once entered the depression north-east of the Ganges, with which it corresponds. Its south-east angle lies near the Chalan Bil, and its eastern limit occurs where the Brahmaputra-Jamuna spills the last of its flood waters. Both these triangles fit the interfluvial segments of the Ganges delta even more closely than the areas of low density to the west overlie the Old Alluvial Uplands.

If over the plain we next compare the rural densities over 900 per square mile with those under 900, it will be seen that almost all the land with the higher density lies east of a line drawn north to south from near the Tista's confluence with the Brahmaputra-Jamuna to the sea. This great tract of almost uninterrupted high density covers about a third of the wholly cultivated plain. The only other large and densely peopled tract is that in the south-west, roughly enclosed by a circle, 30 miles in radius, centred a dozen miles down the Hooghly from Calcutta. Even this includes in reality a large riverside and industrial and suburban population, though the depression, naturally watered by many rivers, is irrigated, fertile, and productive. Of these two ways of grouping densities, the latter is the more significant in our times, for on the whole it is where settled populations have densities above 900 or even 1000 that they are relatively flourishing and are increasing, while below that they are impoverished and sickly, and their numbers are stagnant or actually diminishing. That tracts with highest population should still allow of increase and tracts of lower density produce stagnation is an anomaly which will demand fuller

[1] The words "persons per square mile" are to be understood as following the figure (or figures) of density, here and in the following pages.

attention later. First however let us consider the significance of variation from decade to decade.

Fluctuations and Trend in Changes.—The statistics for 1911–21 showed terrible mortality, and, as was foreseen, those of 1921–31 have compared favourably with them and even with those for the decade before the war. The decade to 1931 may therefore seem to show improvement in health and vitality and hold out promise for the future. Unfortunately we cannot

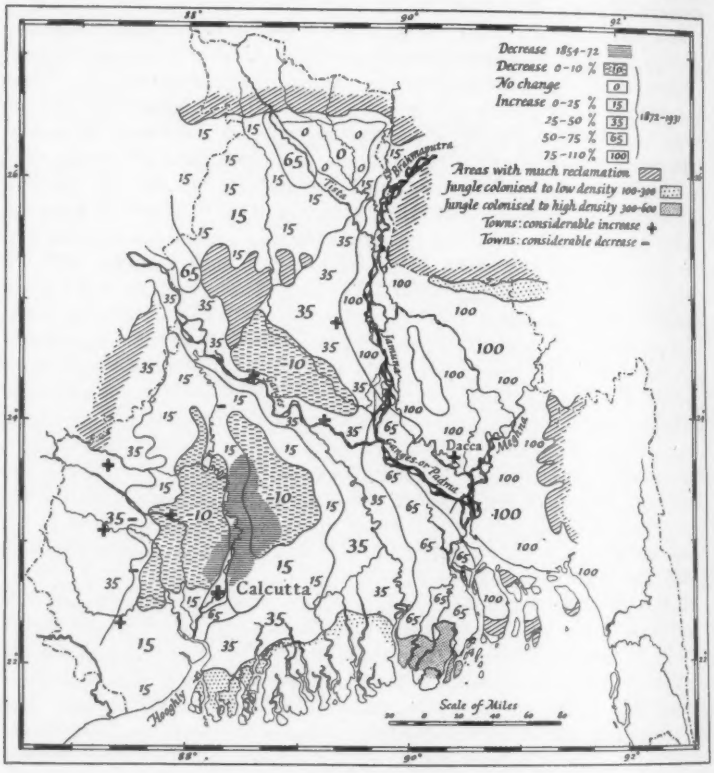


Fig. 2. Changes of population, 1872–1931

call this a true advance, since unless "reconstruction" is undertaken the coming census of 1941 may belie the apparent recovery shown in 1931. Since the calamities of the war and post-war period of 1914–21 were so great, with their combined economic hardship and epidemics, they carried off many who would normally have lived longer, and whose deaths would only have occurred in 1921–31. Their premature decease before 1921 does not therefore prove the last decade to be more healthy than other periods of peace, but is simply to be accounted for by the fact that the war years and those immediately following them were so mortal in their effects; the same is even truer

for India as a whole in these two decades. In other words, when the province was suddenly forced to spend itself in deaths in one decade, it paid its debt to Nature ahead of time and was liable for less at the normal time when it came. Yet, unless assets of vitality are being built up meantime, its people are no better off, and the apparent improvement, judged from a fall in the death-rate, is in part illusory.

In order to gain a true impression of the general trends of population change in the recent past the figures for the twenty-year period from 1911 to 1931 have been taken, as well as those for the sixty-year period from 1872 to 1931. At the same time—since it would be wrong to give an impression of a uniform rate of change for any area, particularly for those smitten by disease—graphs of population change, decennial, annual, and monthly, have also been made, though they cannot be given here. These show how an arrest of growth, or a slow average increase, may be due to dire outbreaks of epidemics, with appalling mortality, as well as to the drag upon natural increase caused by disease which is endemic. Though detailed discussion of change and its cartography must come later, the great changes for the last two generations, from 1872 to 1931, are shown on Fig. 2.

The Principle: Interpretation of Statistics by Topography.—While a cartogram [1] is arithmetically accurate but topographically untrue, a map with the divisions redrawn (in colour or in shading) aims at retaining arithmetical accuracy and combining it with geographical truth. Fig. 3 is an excerpt from my map covering the whole of Bengal and its borderland. It is drawn upon a base map of rivers, which in turn imply the type of relief; and having been collated with other maps prepared on 1/M scale, it not only records the local differences of density but indicates the conditions of site which are their cause. Thereby Fig. 3 (like those mentioned above) condenses on to one map much of the information which I examined upon the 600 1-inch or 150 ½-inch sheets [2] of the province and its borderlands. At the same time it aims at presenting the general features of density at a glance. The correlation of territorial statistics with topographical survey is the method on which the distribution of population according to its density was investigated, and was then portrayed in Fig. 3. Its complement for the portrayal of urban population is the map of Numbers of Population in Cities and Towns (not reproduced). The maps of density and of change for rural and for urban populations were drawn separately and there was no indication of rural population on the map of towns. Where there is a large urban agglomeration however, notably at Hooghlyside, it can be recognized on the rural map, though the numerical importance of its population, and therefore of its increase, cannot there be estimated. The broader zones of density (Fig. 1), simplified from Fig. 3, have already been discussed, and it is now time to consider first the method and next the results of closer analysis and mapping.

[1] A term used by Eckert, Bowman, and Krebs for a statistical distribution map by administrative divisions.

[2] It should perhaps be explained that the publication of (modern) ½-inch maps has advanced greatly since the work was begun, while certain features in the Ten-Mile Atlas of India (Vol. 1. Assam and Eastern Bengal) appeared after I had myself done much of the work.

The work was done on 1/M scale, to allow of the comparison of a cartogram of density by *thanas*, 1931 (showing statistics and boundaries of smallest administrative units), with the map of Vegetation and Land Utilization showing cultivation, groves on natural levees, *bils* or swamp-lakes, and jungle.[1] The "Presidency Map" (1/M) also gives the location of a number of villages such as are notable upon topographical maps, but their number is small, and the choice (not appreciably revised since the surveys of sixty to eighty years ago) is historical or administrative and frequently bears little or no relation to modern density. Where population has stagnated since the early surveys however the villages shown on the Presidency Map may indicate what even to-day is denser settlement, but this map has almost always to be corrected. As explained, the smallest administrative or territorial units other than "census towns" for which population statistics are published by the Census are the areas each controlled by one police station and known as "thanas" or "police stations." Although current statistics for any *mauza* or village may be had on application there are some eighty thousand villages in Bengal and to deal with them all would be a colossal task ! For special study however village figures can be illuminating and some have been used here; a few are noted in gazetteers. Actually the thana is of sufficiently small size for the accurate interpretation of its statistics to present a problem which is generally soluble, but always intricate and therefore of extreme interest.

Correlation of these two sets of data, statistical and topographical, allows of considerable accuracy in the location of population. For a thana is confined to one minor region or tract—be it a stretch of levee or a bil, be it riverside or upland, jungle ridge or cultivated valley—frequently enough to allow the density of other parts of the same zone to be gauged thereby. One can speak of a "zone" or tract with assurance wherever the topography and land utilization are the same and where the average density of thanas is closely similar. The frequent correspondence of thanas to small natural, or "regional," units can be explained by reasons of historical geography or simply of common-sense adaptation in recent administration. Small tracts of country when settled early generally formed units for the collection of land revenue, while intervening strips of jungle or bil separated them as zones of virtual "no man's land." Later, with the opening up of these zones, some were formed into new units, particularly if of sufficient size. Others of course were attached to existing settled areas, but the first case occurs often enough to allow of density being plotted with considerable geographical detail, as has been done here.

Density defined in relation to "habitat" and to 1/M scale.—A scale of 1/M was chosen in order to give completest presentation of the facts, together with economy of space, succinctness, and the elimination of unwanted details. The limitations involved by reduction, as in reproduction, will be all the better understood hereafter. The object of this layered map may be summed up as the visual presentation of the habitat of the rural population of the plain and of its borders; meaning, by habitat, the *unit area of daily life* of this very sedentary population, and not merely that habitation or hut in

[1] Two extracts from these are printed (in combination, as they would be seen superposed on a tracing-table) in Figs. 4a and 4b.

Fig. 3. Density of rural population

which the census officer recorded their stay on the census night. It is obvious that a "hut sign" for each dwelling would give almost absolute completeness and precision of habitation for a scattered population; even so, conventions

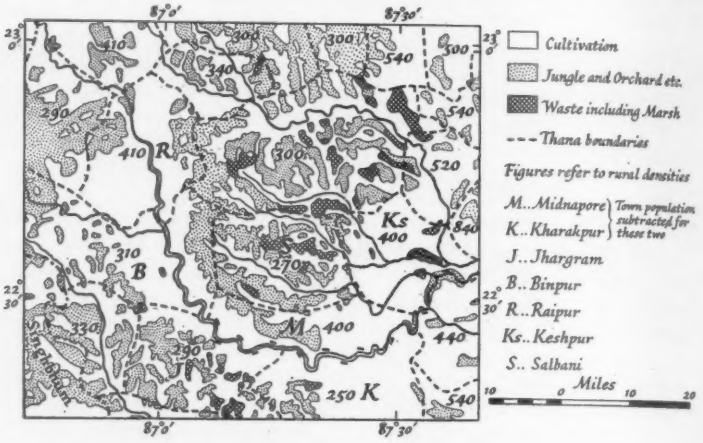


Fig. 4a: cf. Fig. 3, S.W. portion

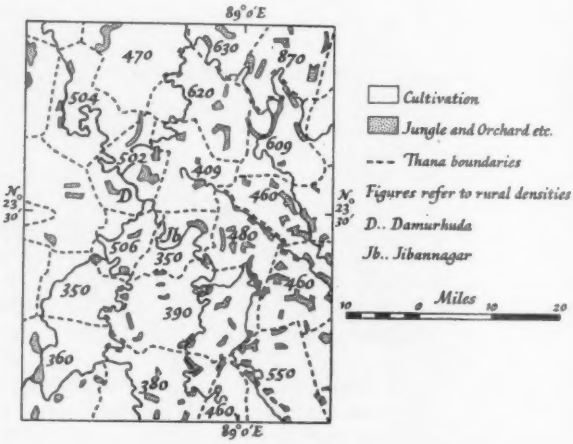


Fig. 4b: cf. Fig. 3, N.E. portion

representing (1) grouping in villages to a given density, and (2) urban concentration would have to be added. By a comparison of the figures of average density for the villages or thanas shown, the hut sign could be given an approximate value equal to so many "huts," or dwelling-places of families of 4·5 persons, which is the average for Bengal. Thus settlement signs upon a

topographical map may (in selected cases at least) be made to serve as fairly accurate, large-scale dot maps of population. It will be clear that, for a really concrete presentation, a dot map of a densely peopled area must be on a large scale, comparable with a plan, *i.e.* not less than "one inch to mile" and ideally of even higher scale.

When we speak of a tract of given density in a land of "sedentary" occupation however we may usefully conceive of something more than mere habitation. We can visualize the occupation of the land in a way which involves a certain daily movement of people at work, accessibly to their homes—the number of these per square mile is then the measure of density. It may be remarked in passing that with this image in mind we replace the conception of *x* persons (*i.e.* individuals) per square mile by that of families per square mile, since, though the men are in the fields and the women and children are usually clustered around the hut, the family occupies a given territory of home plus fields. Now in tracts of West Bengal, where villages are of similar size and are evenly and fairly closely spaced, a map of density, as just defined, does not involve the marking of each village; the density would be the same although habitations were scattered and not concentrated, and whatever the scale, the density (and its layer colour) would be the same. The same is true for the similar land and settlement type in Eastern Barind, with its true villages, or in the North Bengal Fan, with its villages arranged fanwise from the Tista's exit from its Himalayan gorge. Hence the broad zones shown, in uniform colours and to 1/M scale, involve no real elimination of the facts to be investigated. In such cases it would be going into merely local detail to point out that generally in Bengal the fields nearest the tanks of the home or the village, and nearest their manure supply, are more intensively worked and might therefore be given a strictly higher density than those farther out. Thus for the tract as a whole the generalization just made holds true.

Where however we pass in West Bengal into the gentle vales between the upland wastes there are contrasts of density. Similarly when we turn eastwards to the Delta the zones of greater and of lesser habitability do not allow of uniform density. The majority of the population live upon the natural levees, and they work near them, leaving a minority to dwell nearer the middle of the intervening depressions and to cultivate these. Just how far the actual zones of home and field are restricted to the neighbourhood of the levees it is hard to say without village figures. Moreover the menfolk go to the sides of the bils in the depressions, as these dry up in the autumn, to cultivate them and again to harvest there. However it is certain that the non-agricultural population, such as village artisans, keep to the levees for the sake of safety, comfort, and ease of communication (whether by land or water), and, probably, of health. This alone makes a difference of 20 to 30 per cent. in favour of the levees; moreover their sides are more intensively gardened and cropped than the depressions. Now in steamy Bengal, with its muddy tracks, the actual mileage of daily travel by the workers and their oxen is small; a couple of miles as the crow flies is heavy travel before and after a day's work. That being so, the zones of greater density along the chief levees may be thought of as usually 3 or 4 miles wide. The intervening depressions may be wider, but the bottoms of these, with their bils, are usually 2 or 3

miles wide, and sometimes more. At times however three or four levees, corresponding to stages in past river movements, are festooned together and their zones of greater density consequently run into one. Since $\frac{3}{16}$ inch represents 3 miles to 1/M, it will be seen that this scale is fully adequate to represent density, as here defined, without loss of detail. The Census statistics give precision to topographical indications of denser settlement for thanas with a high proportion of levees, and of sparser settlement for thanas adjacent to these and containing much interfluvial depression. It is such correlations as these which permit of the detailed plotting exemplified below.

Relative Value of Hut Signs.—The impression of differences in density given by differences in the closeness of hut signs upon a topographical map has been made use of. There has been however but little actual counting of hut signs per unit of area. Recent "Professional Papers" by members of the Survey of India point out the impossibility of giving a numerical value to hut signs in the survey of a country whose rural density varies from semi-desert or jungle to teeming rice land. They also make it clear, by constructive criticism, that the reduction in the numbers of hut signs shown on Survey of India maps has not systematically followed reduction in scale, at least up to the last ten years. Examination of other inquiries has shown me the liability to misleading results due to too great a reliance upon the counting of hut signs.

Grades of Layering.—The colour intervals of density chosen for the original map represented grades from uninhabited to densely peopled tracts by steps of 1–99 (or 100), 100–200, and so on up to 1000, after which the steps increased.[1] To the geographer seeking ready visualization of regional conditions a simple layer scale has its advantages; *i.e.* a scale which shows detail but the colours of which express continuous gradations, save where a step from one grade to another is seen to be significant. At the dividing line of 300 a change was made from green (below 300) to yellow (above it), to indicate the correspondence of increased density with a difference in land utilization. Thus a dark green represented density below 100, usually (around Bengal) below 60, and a zero printed upon this dark green indicated uninhabited jungle (the Sunderbans). According to the amount of clearance, chiefly, population is higher, and densities up to 200 and 300 were shown by paler tints of green. At 300 the colour changed to yellow, for a density of 300–400 corresponds generally to tracts which have been completely cleared and cultivated. From 300–400 the colour scale ascended by steps of 100 to reach 1000, after which the steps increased by 150 (1000–1150, and next 1150–1300), then by 200 (1300–1500), then 300 (1500–1800), with black to represent "rural" densities of over 1800 which actually reach to nearly 3000. The increase in steps is of course to compensate (in part) for the propor-

[1] The maker of the Census cartograms, approaching the matter with arithmetical considerations in mind, emphasizes the arithmetical average of density for the province (646). As seen however this is of no great geographical value in itself; and in any case the approximate density of the plain would be more relevant, whether its general average (about 715) were taken, or the rural average, which happens to be much the same as the general average for the province. Finally the actual shading adopted was unfortunate, the differences between increase and decrease being almost indistinguishable.

tional density represented, for though 200 is double the density of 100, 1100 is but a tenth more than 1000. Above 3000 the settlement begins to be urban or suburban in character. Resort was then made to circles (not reproduced), the radius of each varying proportionately to the square root of the number of the population of each town.

Examples illustrating Method.—To show the type of data, and to make the method clear, examples are chosen from Western, Northern, and Central Bengal. Among the jungles of further West Bengal, where clearings are scattered and hut signs relatively few, the topographical maps make it clear that population, largely Santhal, is lower than in the rice lands of the vales that penetrate this zone, and lower than on the slope down to the true deltaic plain. In Fig. 4a such a thana as Salbani has still remains of *sal* jungle and much waste and includes no continuous rice land; its density is 270. Thanas mainly cleared and cultivated like Raipur, near the provincial boundary, or Keshpur, on the cultivated Old Alluvial slope, have densities of 410 and 400 respectively. These three are fair samples of the densities to be expected according to the land utilization. Most other thanas of these zones show average densities which vary proportionally to the amounts of jungle and cultivation: Binpur with a density of 310 has much mixed jungle and clearing and little continuous cultivation, or Jhargram (jungle village) with a density of 290 has still more jungle and less cultivation. These averages, lying between those of the three thanas named above, confirm the figures already found to be typical for jungle with clearings (as in Salbani), or for uninterrupted cultivation, as in the other two. Hence the distribution of continuous cultivation and of jungle with clearings (plotted in MS. to 1/M scale) furnishes a good basis for densities respectively of 200–300 and of 300–400 or 450. Actually however conditions are not quite so simple as might seem. In one thana a land-owning family, generous to its Santhal immigrants, will encourage more of these to come and settle, while elsewhere another may end by making them "flit" in large numbers. Beyond the provincial boundary, too, the demand for labour at the iron mines of Singhbhum or the coal mines of Jheria may be brisk, withholding emigrants or attracting immigrants; or the demand may fall, with a slump in trade, and Santhals flock over the boundary at the nearest point to break up new land. Hence land utilization alone is an insufficient datum for density; along with this account must always be taken of the average density for each thana in order to determine the true densities tract by tract.

In west Central Bengal, eastwards from the Bhagirathi, the land utilization brings out, along with the branching of the rivers, the bamboo clumps, orchards, and settlement upon their levees (Fig. 4b). A thana such as Damurhuda, with a density of 502, has much levee; another such as Jibannagar, with a density of 350, has little. The topographical maps also make it clear that the levees are lined with settlement while the interfluves, though not without hut signs, are thinly inhabited. Hence it is clear that the bands of orchard-covered levees must be given a higher and the interfluves a lower density than the average for the thana. In these cases riverside strips, 2 to 4 miles in width, are given densities from 400 to 600 or even 700, and the interfluves are shown as from 200 to 300 or 400 (Fig. 3). A cross-section of a

typical portion of deltaic country from river to interfluve illustrates the correspondence of the natural levees with population (Fig. 4c) typical of the Jessore district in the west central delta.

Other examples may be noted (Fig. 1). Thus along the Himalaya foot in North Bengal there is much almost uninhabited forest included in thanas with average densities of 186 to 430. Since forest density must be counted as less than 100 (say 50) the remaining cultivation must support a density of some 300 to 450 or even 550. The character of the land utilization shows great uniformity, once the forest has been cleared, along zones arranged across the radiating rivers of the great North Bengal Fan. Thus from a patchwork of "average" densities on a cartogram there emerge unmistakable zones fitting the land forms southwards from the hill-foot, the densities beyond the forest (below 100) rising from over 200 to over 300, and to over 400, then over 500 as the mountains are left behind, with a tongue of high density pushed northward up the Tista.

In certain cases however difficulties occur and the exact distribution of settlement may be open to doubt. The alternatives here are either to leave the distribution much as it is averaged on the cartograms, in spite of the

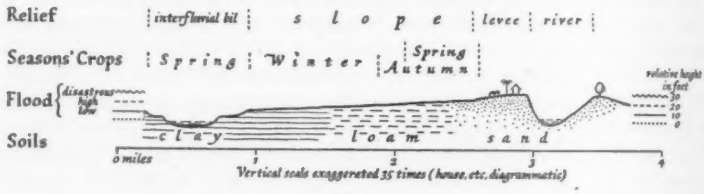


Fig. 4c

unlikelihood of this being the true distribution, or else to arrange the population as seems likeliest from the data. Where I took the latter course I have given the figure with a query, both to record the uncertainty and in order that the validity of the rest need not be called in doubt. The distribution which appears most probable is worth mapping, but it invites query later and correction by detailed mapping of the statistics for villages (mauzas) preferably correlated with regional study on the spot. Small, typical areas might serve as samples for larger regions in which they are included.

Cases of doubt are the densities of population in the south-west Sunderbans, where however the local differences of density must vary but little above or below 400 or 500. There is some doubt too in the most crowded areas of East Bengal, for though the levees and the old village sites are becoming more crowded year by year, the poor cultivators settle in the interfluves. The average densities, usually very high as it is, have been left as recorded by statistics, save where there was clear topographical indication of varying density. Intensive regional study of parts of East Bengal would probably reveal numbers of levee belts, many miles long, with continuous densities equivalent to those of European garden cities, with ten or twelve houses to the acre, or about 30,000 persons per square mile.

The Maps of Change, their Construction and Significance.—Change, or

periodical variation, in numbers and density of population is here represented by two maps which portray different aspects of the recent past. As for the maps of density, so for these, the essence of the method lay in the correlation of cartograms with topographical data, chiefly by help of the text of the Reports of the Census for 1931, 1921, and previous years, back to 1872. Of the maps reproduced here the first is a sketch-map of tracts of change by natural zones for the sixty-year period 1872–1931 (Fig. 2); the

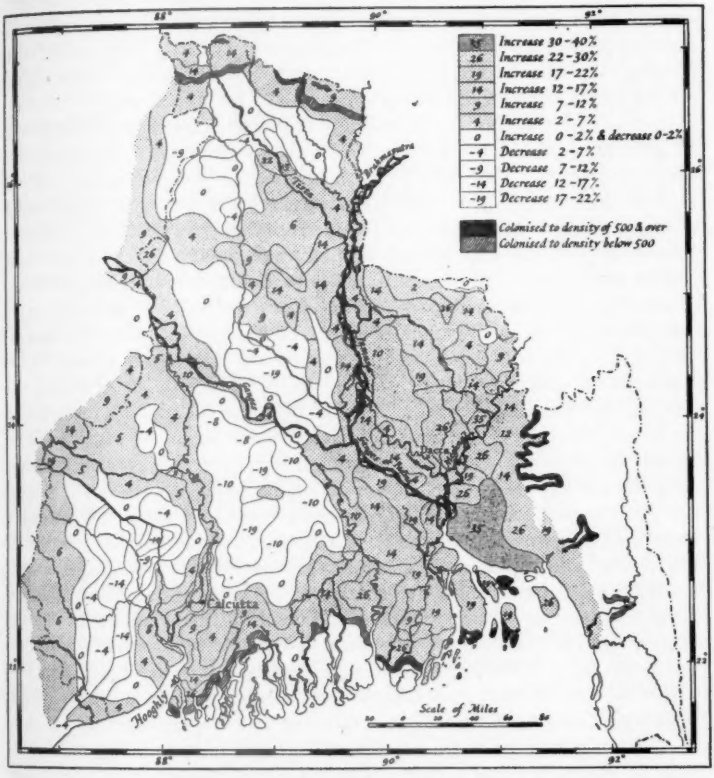


Fig. 5. Changes of rural population, 1911–1931

second shows recent changes of rural population 1911–31. Fig. 2, the map of changes from 1872 to 1931, has already been noticed, and in it the rural have been separated from the urban changes. Fig. 5 requires fuller discussion. Space does not allow comparison of the decade 1911–21, which covered the war period and which witnessed widespread arrest or retrogression of population, with the last decade, 1921–31, which suggests better conditions than can be expected to continue. In order to soften these temporary contrasts and to elicit the general trend of rural change, a cartogram was drawn for the

twenty-year period 1911–31. It formed a fairly reliable statistical basis from which—by comparison and correlation with the text of the Census Reports, with topographical data and the maps of density—the map of change by natural zones was compiled to 1/M scale. The object of this map was to locate the zones of variation by help of known natural features (rivers, relief, soil, and subsoil), and so contribute to a regional synthesis (Fig. 5). In this map the changes due to circumstances—such as the epidemics, the slumps and booms of the war and post-war period—are generalized, while there emerge the main trends in the growth or decay of regions. The trend moreover is typical of the main lines of change over the last sixty years, and it points to what may be expected for the next quarter of a century or more, unless radical reforms of land utilization and economy are undertaken.

In detail the method of examining the local differences in change and of portraying these on Fig. 5 was similar to that used in making the Map of Density. First of all administrative units which clearly formed parts of one natural region were taken as criteria for the region. Units which belonged partly to one region and partly to another were subdivided and their parts re-apportioned—an upland portion to an upland region, a river bank portion to the rest of its riverain tract. In particular attention was paid to the relative density of different parts of the administrative units in mapping the true areas of change. Four chief grades of density, for which the layered Map of Density, simplified (Fig. 1), formed the basis were shown by the shading with which the colour was laid on. The importance of density was very real in estimating the real zones of change, besides adding to the value of the final result on Fig. 5. Thus, while each *colour* upon the map signified a certain change in population, as for example ochre for 7–12 per cent. increase, the three *shadings* used in each colour denoted population densities of respectively 100 to 500, 500 to 900, and over 900 per square mile. Areas of density lower than 100 were left white. In the Barind, for instance, an increase of 7 to 12 per cent. means a small increase of actual numbers per square mile, but in crowded East Bengal, for an area of the same extent, the increase of actual numbers is very large. Thus the resulting map indicated both the increase and also the density of the east; and similarly it showed the stagnation or decrease of the populations of the centre and west of the Delta and of the western alluvial fans, together with their population density, which is generally low. Again the highest increase in a large area already densely peopled is reached in south-east Bengal where a tract 20 to 40 miles wide along the eastern bank of the great Meghna estuary has attained to a density not simply of over 900 but of 1200 to 1600, by an increase of about 35 per cent. The importance of finding a method of mapping these two related facts on one map will be clear. This method of shading plus colour can moreover be applied in the correlation of any two related distributions, such as the percentage of area cultivated with that of some key crop. The value of this method for geographical research is not diminished by the fact that the reproduction in colours is very expensive.

The increase due to colonization of uninhabited zones is yet another feature necessitating the construction of a map of variation which shall be true for the actual areas tinted (Fig. 5). Colonization means not simply an increase

of population contained in an administrative unit (as shown on a cartogram), but an extension of the habitable area. For this reason, colonization of forested swamp or hill or of grassy mud banks and islands thrown up in the Meghna estuary is distinguished from the averages for thanas which include a strip or zone of reclaimed waste. The sites of islands and coasts "diluviated"[1] out of existence must also be shown. These zones were determined by examination of the areas marked off for colonization on recent topographical maps, and by comparison of editions of different dates (particularly of places I had visited), as well as from the text of Census and Settlement Reports.[2]

Cities and Towns: their Populations.—The area of the circles in this map (not reproduced) represented (*a*) the number of the population of each city or town—the square root of the number giving the radius, upon the scale shown; and (*b*) the amount of change in two generations. There was no difficulty in expressing the population of the towns which are scattered over the province, and their pattern stood out boldly.[3] The total population of all the towns of Hooghlyside, including Calcutta, was also shown as one: a circle of which the segment drawn predominates over all the rest.[4] It thus represents the overwhelming majority owned by that conurbation of more than two millions over the remaining urban population, whose one and a half millions are scattered over the province. Increase is connected with the commerce and industry of Hooghlyside, with Dacca's jute trade and (generally) the well-being of the east, with the addition of the coal-mining at the edge of the Chota Nagpur plateau. Decrease in western towns is chiefly due to the decay in agriculture and health.

Conclusion.—There is thus considerable correspondence between general growth and continuity of change on the one hand and between arrest and alternations of growth and decline on the other. Indeed not only is the resultant character at the close of a period important but the measure to which the population fluctuates during that period. If we take as an analogy the climate of any region of India, we know that this is to be measured not only by the mean of the annual rainfall but by its "variability," *i.e.* by the liability to excess or defect from the mean. In the same way not only the mean rate of change in numbers of population is important but its liability to fluctuations, its "variability." Again with rainfall it is usually found that the higher the mean the less the variability. So with population it is frequently true that the higher the percentage increase the less the variability, and vice versa. Where disease is a direct cause of high mortality however this is not always so. It has been noted that an epidemic of malaria, with its sudden

[1] The official term in Bengal for an area swept away by river or tide.

[2] While I hope that greater accuracy for stated periods may be attained by help of official figures, for which I inquired, the zonal arrangement indicated presents the facts with reasonable truth.

[3] The alignment along the Hooghly banks presented a special problem and a complete portrayal was in danger of leading to a confused mass of interlocking circles. To avoid this, on a MS. map to 1/M scale, not reproduced here, only a segment of each was shown, while in a few cases towns formerly one, but recently subdivided, were treated as one.

[4] In 1872 Calcutta numbered 700,000 and the rest of Hooghlyside some 350,000; in 1931 Calcutta had reached 1,200,000 and the rest 900,000.

toll of deaths in the first three years after its appearance, is followed by an endemic stage, less mortal but of indefinite duration, and inflicting yearly toll. Thus, though the endemic death-rate soars yearly in the malaria season, the annual or decennial changes are not so great as in areas of famine or of epidemics. In India as a whole the drop in population in 1911–21 was still greater than in Bengal, while the rise in 1921–31 was rather higher. The reasons were that famine and the epidemic of influenza worked greater havoc in most of India during the first period than in Bengal; but during the second period epidemics were absent and health, on the whole, was better in most of India than in those tracts of Bengal which were endemically diseased.

The record of variability is highly important as an indication of the occurrence of deaths in a stricken people. To find this a simple formula has been taken to express a normal curve of population change from 1881 to 1931.[1] The famine districts of the Deccan lava tracts and of Rajputana, which have a total increase of 10 to 20 per cent., show a *variability* from a normal curve of as much as 10 per cent. (and even as much as 15 per cent.), due to the losses in famine years. In Bengal however the highest district variability is 3 per cent. on the western uplands, on which I have shown the change in fifty years as +45 to +20 per cent. in the jungles, down to almost −10 per cent. on malarious fans and the Delta (*cf.* Fig. 2). In the western central Delta proper the decrease of almost 10 per cent. has been accompanied by a variability of only 2 per cent., so unvarying has been the effect of endemic malaria since before the first census. In Eastern Bengal districts however, with their total increase of almost 100 per cent., the variability has been less than 1 per cent., so steady has the rate of increase been.

Meantime the calamitous state of the whole of the western and central Delta calls for urgent action. There is little doubt that in this land, which less than eighty years ago was an abode of health and of high civilization, the water and silt supply for agriculture can be increased, and with this malaria can be largely controlled. Unfortunately inattention to crops and health and concentration on such modern advantages as cheap railways, roads, and canals—run across the natural drainage system and designed to serve the commerce and industry of Calcutta, London, or Dundee—form part of a general disregard of the peasants' own food supply and health. It is this which has permitted, and even helped to bring about, the tragedy of general decay and death. The concern of this paper however is simply to state the facts and to explain the method used to ascertain them. There is perhaps no matter in which human geography can be of more vital informative service to mankind than in this one of the precise mapping of density and change of population.

APPENDIX: POPULATION DENSITY FORMULA FOR RE-INTERPRETATION OF STATISTICS IN RELATION TO TOPOGRAPHY

It may sometimes be justifiable to sacrifice statistical accuracy in order broadly and visually to generalize a geographical distribution; this has frequently been done in population mapping and, unfortunately, it has become so general a practice that loss of accuracy is assumed if administrative boundaries

[1] The formula was kindly worked out by Mr. A. C. Aitken, D.SC., F.R.S., and the results computed by Miss Drever, M.A.

are not actually shown. The method described however adds to the essential facts derived from habitat without any loss of statistical accuracy whatsoever, as the following example will show. When, in an administrative area of A square miles, the Census returns show a total population of P persons, and it is desired to redistribute these according to the varying character of the habitat, then, suppose p forest dwellers to occupy an area a of forest, the remaining population $P-p$ will be found on the remaining area $A-a$ of cultivation, and the respective densities are $d_1=p/a$, and $d_2=(P-p)/(A-a)$.

This formula will show that in each small administrative area the total population is left unaltered; it is not transferred to any other but is simply redistributed within the boundaries of the area. Hence the sum of these products (density × area), either within the small area or within the whole province, must represent the correct total of population. The total population, as represented by densities in given zones, would be unchanged even had the first assumption of a reduced density for the forest, a, been absurd and contrary to the truth. Naturally however no change in the distribution will be made without good reason. Hence statistical accuracy can be preserved to a nicety while geographical common sense is also applied, and thus is reached a very close approximation to actual truth.

Note on the Maps

Dr. Geddes' paper was accompanied by a series of maps which it has not been found possible to reproduce in full. The series consists of large sheets about 30 × 26 inches based upon the outline of the map of the Presidency of Bengal (Second Edition) 1/M, No. 1502 D.21. We have to thank the Surveyor-General of India for permission to use the outlines of this map when preparing the figures for this paper.

II. Physical features of the Delta and Uplands 1/M.

III. Contours of the Delta and its borders sketched from Survey data and Railway Ground Levels 1/M.

IV. Vegetation and land utilization reduced from topographical surveys. In four colours.

V. Cartogram of density by thanas 1931.

} Figs. 4a and 4b are small pieces of IV and V combined.

VIa. Density of rural population 1931 in five colours 1/M. Layered and simplified. (Reduced in Fig. 1.)

VIb. Density of rural population in sixteen colours 1/M. Layered in detail. (Fig. 3 is a portion of this in black, the colours being represented by numbers and shading.)

VIII. Changes of rural population 1911–1931 1/M. In eleven colours denoting percentage increases, drawn in solid and two rulings to show density. (Simplified in black in Fig. 5, the colours being represented by numbers.)

IXa. Changes in population of cities and towns 1911–1931 1/M. Diameter of circles in mm. $=\frac{1}{10}\sqrt{\text{population}}$.

IXb. Size and changes in population of cities and towns 1872–1931 1/M. The population at these dates is shown by circles, whose diameter in mm. $=\frac{1}{10}\sqrt{\text{population}}$. The areas of the circles are coloured green (1872) and yellow (1931).

The Bengal Plain: changes of population 1872–1931. In six colours. 1/2 M. (Reproduced as Fig. 2 in black.)

All the above are deposited in the University Library, Edinburgh.

ED.—*G.J.*

DISCUSSION

Before the paper the PRESIDENT (Major-General Sir PERCY COX) said: Dr. Geddes is going to address us this afternoon on the subject of "The Population of Bengal, its distribution and changes." Dr. Geddes is Lecturer under Professor Ogilvie at Edinburgh University and he is making sociology and human geography his special study.

Dr. Geddes then read the paper printed above, and a discussion followed.

Professor C. B. FAWCETT: I was much impressed in the commencement of the paper by the attempts to get, first, an accurate statement of the facts observed. I am quite certain that it is essential to get our facts stated as accurately as possible; and that at once leads up to the particular fact Dr. Geddes has dealt with finally, viz. density of population. This "density" is, of course, a mathematical abstraction: it is a relation of the numbers of the people to the area of the district within which they were registered when the Census was taken. One could spend a good deal of time considering whether this density, the pure figure, is itself the most important of the facts dealt with. I will not however go into that because it will lead farther than most of us would like to go now. It raises the whole question of the basis on which the maps are drawn.

There are some other points in the paper to which I should like to refer. One point which Dr. Geddes has not stressed but which comes into his paper is a reference to the Hooghlyside conurbation; and the figures given suggest that its population is extraordinarily unstable. If I may quote them, there is the fact that the proportion of males to females in the city population is two to one, and that the number of those in the city who were born outside the Province of Bengal, that is, have emigrated from some considerable distance, is one-third of the total. Those figures alone give an indication to any one who has studied population figures that the conurbation is in a state of great instability. That does not come out in any of the maps. Inevitably, because Dr. Geddes was dealing with something else, but it is a fact of great interest in regard to many social, and perhaps also political, conditions in Bengal.

There is a note in the paper (p. 347) dealing with what Dr. Geddes has described as an anomalous condition: that the crowding of the population is greater in the prosperous areas and the population is most prosperous where it is densest. I was glad to see that particular fact brought out in this study because some of my studies within the last few years have led me to the conclusion, at present tentative, that it is not an anomaly but a fair general statement of facts at the present day, that the areas in which conditions of life are such that people can get a better living are the areas which are tending to become the most crowded and that, on the converse, those areas which for any reason do not offer such prospects of good living tend to become depeopled. That does not appear to me at all an unreasonable conclusion, but Dr. Geddes, finding the facts fit in with the tendency which I have just stated, calls it an anomaly, or apparent anomaly. I should like to know why it is considered anomalous. It is one of the most important facts in present-day movements of population that improvements in transport facilities allow that tendency fuller play.

Then there is the interesting note giving particular instances of the fact that one might have thought right on general grounds—but generally *a priori* grounds are unsatisfactory bases for reasoning, although often useful guides as to what to look for—the fact that here Dr. Geddes has produced definite evidence that a low death-rate over a comparatively short period, in this case

ten years, is not in itself a conclusive indication of either well-being or the opposite. A low death-rate does not seem conclusive evidence of the well-being of the population unless it remains low over a period which I should put, tentatively, at a full generation at least. For shorter periods either a specially low or a specially high death-rate may be due to quite accidental and temporary causes.

The paper as a whole has raised a number of interesting points. As to the map question, it is interesting to know that Mr. Williamson has here a population map of Bengal on the "dot" method; and that we may be able to compare this with Dr. Geddes' maps.

I should like, in conclusion, to congratulate Dr. Geddes on getting down to a careful study of the precise facts with regard to an important area, an area which is so large and deals with so many people that, unfortunately, it is not possible to deal with the facts in very great detail. That is one of the inherent difficulties of population study. He has dealt with a population of over 50,000,000; and if he got down to individual villages he would have to deal with 80,000 villages. The actual magnitude of the numbers involved is perhaps the greatest difficulty of all in the making of a precise study of such a province, and hence one might suggest that such studies can only be of real value if they are supplemented by much more detailed studies of typical areas, that is, areas within Bengal selected as being typical of different conditions, and so small that it is possible for the study to get down to the details of the individual villages and possibly even of the individual settlements. With that suggestion I should like to conclude by congratulating Dr. Geddes on a paper which is a real and valuable contribution to the study of population.

Mr. A. V. WILLIAMSON: I want to commence by congratulating Dr. Geddes upon what is certainly a most important contribution to the fundamental aspect of the question of the population of India. Professor Fawcett closed by expressing the opinion that this was not detailed work, but I who have had something to do with trying to work towards a map of the population of the whole of India regard it as highly detailed work. I would suggest to Professor Fawcett that if such work sought to be "detailed" in the sense that he has defined, it would lose much of its value.

As I have said, I am personally interested in trying to work towards a map of the population of India as a whole, and I think I can say, without fear of contradiction, that only for Bengal does the present state of knowledge and the material available, apart from other considerations, enable one to do work, at a distance from the area, in anything approaching the detail that Dr. Geddes has introduced, much of which reflects his first-hand knowledge of the area.

Let me elaborate this statement a little. In the first place, topographically, Bengal is a very simple area. There are none of those difficulties which are inherent in, for instance, Mysore. Bengal is a country of more uniform topography which makes for simplicity, particularly when working on the method which Dr. Geddes has employed.

In the second place, Bengal shows, over the whole of its plain area at least, a high-average density. Therefore I think there is perhaps less room there for major errors in mapping population than in an area characterized by wide variations in densities within narrow limits. There are, it is true, great variations between adjacent thanas within Bengal—in Dacca, for instance. Nevertheless, thinking of the plain of Bengal in its entirety, it has a close settlement with a high-average density of population over the whole of its face in comparison with areas of similar size throughout the rest of India.

Thirdly, I think I can say that there are in existence in regard to Bengal more aids to careful detailed mapping than is the case in any other province

or state in India. Dr. Geddes has mentioned the publication of the Ten-Mile Atlas, and I shall show you presently a map, depicting the distribution of population in Bengal, which has relied very largely on that Atlas with some reference, in special cases, to larger-scale maps, though I am not for one moment suggesting that this map has behind it research based on the scrutiny of six hundred 1-inch sheets.

I would like specially to emphasize the point to which I am now coming because of certain criticism on the part of Dr. Geddes as to the "cartogram," that is, the map showing the facts of population by administrative units. I only wish that the several Provincial and State Reports of the Indian Census had given us what the Report relating to Bengal has given in this connection. It would be invidious to draw distinctions between the standard of general excellence of these several Reports, but at least in this matter of cartography, very important to us as geographers, Bengal is the peer of the rest. With all their limitations, the cartograms in the Bengal volume present reasonably fair pictures not only of the density of population at the present time, but of the changes in population such as Dr. Geddes has been dealing with. These cartograms employ the smallest administrative unit, *i.e.* the thana, which though not as small in Bengal as in the United Provinces is much smaller there than throughout most of India. There is no other province or state which uses the smallest administrative unit in its census cartograms. Because of the small size of the thana, coupled with the topographic monotony of Bengal, these cartograms give us very close guides to the larger facts, at any rate of population density. I have emphasized this because I hope that at the next Census many other provinces and states will follow Bengal's lead and put into our hands similarly detailed cartograms, if possible. I think Dr. Geddes, if he has had occasion to use other Census volumes, will share my hope. As a geographer his criticism of the cartogram stands of course. But if some of you will, in due course, carefully read the paper alongside the cartograms in the Census volume of Bengal, you will, at any rate, be able to follow some of its finer points and will recognize that they are brought out on those cartograms in a most useful way.

I should now like to come more precisely to certain points in the paper. It is striking to note that, as Dr. Geddes has emphasized, the density of population in Bengal is lower on the Old Alluvium than on the New; this is in striking contrast to the rest of the Ganges valley. Take the United Provinces and you will find there exactly the reverse. So also in the Assam valley, and in Bihar and Orissa Province. The reasons for this difference between the lowermost part of the Ganges valley and the rest of that valley are worth investigating.

I would just recall now that towards the mouth of the Ganges, *i.e.* in the essentially deltaic area, the New Alluvium is, of course, much more silty than it is in the United Provinces. In the latter, in fact, it is characteristically coarse and sandy and does not hold water well; it is, too, liable to be eroded rapidly along the riversides. Hence it is much less preferred than the Old Alluvium forming the higher land free from flood and giving a finer, essentially loamy soil.

But this is certainly not the whole explanation of the contrast to which I have referred because, while it might account for population density being higher on the New Alluvium in Bengal than elsewhere, it does not account for it being lower on the Old Alluvium. Probably what we have here in areas above river-flood levels is intense leaching under heavy rainfall over a prolonged period during the year giving a tendency towards development of laterite soil. Thus the Old Alluvium in Lower Bengal probably gives rise to a soil which is inherently

much less fertile than in the United Provinces and elsewhere. One could suggest other possible factors and I should like to hear what Dr. Geddes thinks.

I now show you the map, though I feel it a little discourteous to take up time in this way. I do so only because I want to make the fullest possible contribution to the recognition of Dr. Geddes' important work. Thus I have brought this particular map along because, within its limitations, it confirms the map produced by him. In Leeds we have also made a map of Sind, an area which is at the other end of the scale of density to Bengal, and one of the State of Mysore, just to try out the dot method in areas which show strong contrast in one way or another. I think you will be able from this map to pick out the contrast between the west and east in terms of density which Dr. Geddes emphasizes. You can also distinguish the lines of greater density up the vales between the slopes of the Old Alluvium in Western Bengal, the massing along the levees, and the great "break" in density on the Old Alluvium of the Madhupur jungle. The obvious thinning in the western part of the Sunderbans, and even in those areas which Dr. Geddes refers to in his paper in terms of two triangles situated west-centrally in the delta, can also be discerned. But I must conclude and I do so by again thanking our lecturer for his valuable paper.

Mr. A. C. O'DELL: I should like to add to the congratulations of the previous speakers those of a worker in demography, a mapper not of millions but of an entirely different type of settlement. Different as the work has been I have met sufficient of the difficulties to appreciate the problems Dr. Geddes has had to tackle and offer the following comments in the light of my own experience. First of all I wish to query Dr. Geddes' statement that it is possible for a layered map such as this to retain complete arithmetical accuracy and at the same time combine with it geographical truth. The map is essentially a demonstration medium and as such it is necessary to use interpretation in order to turn the "cartogram" into a picture of the essential features of the layout of the distribution of population. Dr. Geddes has had a delicate touch in his interpretation of the bald figures of the thana densities and it is partly this skill that makes his map on the scale of 1/M have such a greater appeal to the eye than the crude colouring of the administrative areas. I feel it is a pity that Dr. Geddes did not see his way to the inclusion of urban settlement on his maps of density. One feels that the inclusion of the denser urban groupings would have automatically explained the zoning of certain of the densely rural regions. The second slide and the third make a good contrast in this respect, for the latter has symbols for some of the more marked urban changes which give a clue to the rural changes during the same period of change. It was a happy thought to mark on these maps the areas that had been colonized in the period.

I venture to raise doubts as to the efficacy of adopting such a rule of thumb method of zoning the density for mapping purposes. Instead of the sixteen zones of Dr. Geddes I suggest that it would have been better to have taken a trial strip across the map and plotted the thana densities as published in columnar form. The various densities could then have been examined to see how they grouped themselves according to the Bengal conditions and zones delimited with the following points in view: (*a*) to avoid too large an area with one flat wash colour, and (*b*) to pick out significant densities that can be given a definite title. A thana that lies within this zone and has a uniform population distribution can give its name to the type and the building pattern displayed on modern detailed maps, and give precision to what is for most people an abstract statement, viz. density to the unit area. Finally it would be an advantage in my opinion to avoid the use of black for a high value. Black dazzles the eye and bears no relation to the colour scheme. Instead of colours a layering of the map in

monochrome would, I think, have given a more ready way of visualizing the crowding of people, for the weakness of discrete colours is their varying force of appeal to different people with normal vision. One person concentrates on the red and another tends to have his attention taken by greens, while a third ignores yellows.

Dr. GEDDES: Professor Fawcett noted the importance of representing instability, not only in rural populations (as indicated towards the end of my paper), but also in towns. If instability or variability can be measured by a percentage and its distribution represented by layer colourings for rural tracts, it should be easily possible to represent urban variability in much the same way. Within circles of which the area represented the population of the towns, the colouring would indicate the variability. Of course a map of change, in any form, is not enough: graphs are needed to supplement maps where time is to be portrayed.

In speaking of an *apparent* anomaly of increase in an area of high density and of decrease in an area of low density, I had in mind a comparison with increase in lands open to colonization in India, for instance the Punjab irrigation area or the forests of eastern India. The causes which prevented eastern Bengal reaching a limit of support for its population as yet seem essentially due to past conditions; that is, its forests were difficult of clearance and detained advance. In western Bengal however the causes which induced an actual fall in population are of more recent date and are largely due to man's interference with natural drainage and inundation. These facts are due to subtleties of hydrographic conditions which are not suggested by any map of the Delta hitherto published; hence "the apparent anomaly." The cumulative concentration of population masses in industrialized lands to which Professor Fawcett has rightly drawn attention is much less noticeable in Bengal, so predominantly agricultural. In fact it is eastern Bengal, rural and relatively outlying, and not the rural neighbourhood of urban Hooghlyside, which has grown in population.

Professor Fawcett rightly spoke of the value of detailed studies, and I must at once own the value to me of initial studies I was able to make in Bengal and further reaffirm my sense of the value of future studies. Their purpose however I should specially consider to be the interpretation of cause and effect upon the facts, for I am satisfied that the statements of facts of population made above would not have to be materially altered, whether textually or cartographically, because of local studies. Local studies are specially helpful if you select areas which are really comparable—areas of deltaic plain together, or areas of upland or of lowland—and, taking one of these, you then compare the general and statistical facts of the whole with those you have been able to study in detail. Detailed studies must be related by those who make them to wider areas, if they are to be of real service in leading to reliable generalization.

Mr. A. V. Williamson has rightly pointed out the value to the geographer of giving figures and cartograms for small areas, as in Bengal. It is fair however to add that the Census officials are most obliging in furnishing more detailed figures in MS. for other areas so as to allow of further accuracy in geographical study. Nevertheless it would be of the greatest help if the detail given for Bengal could also be published for other provinces and states.

As regards topography however the problem is more, not less, complex for a plain like Bengal than for areas such as the Chota Nagpur Plateau. In the first place, the distribution of cultivation and of jungle is a more distinctive indication of population density than any to be found on a wholly cultivated plain. Secondly, the relief, being more pronounced, also makes types of settlement conditions more, and not less, easily recognizable. Hence correlation of

land utilization and of relief (altitude, slope, and nature of dissection), using some such means as "the statistical mesh method," should allow of thoroughgoing analysis of the factors of population distribution. For the Plateau of Chota Nagpur I have already had prepared under my direction a map of the distribution of waste and of cultivation, reduced from topographical maps, and a comparison of this with relief is most suggestive. This has since permitted the completion of a population map of the Plateau and neighbouring plains. Comparison with soils must of course be made to explain causation, but this, in spite of the absence of soil maps, can be done with a fair measure of truth when the above data have been plotted, together with the geology of the region. In my opinion, then, the methods worked out here for Bengal (and, as you see, for the highlands immediately around it) are applicable to the whole of India. Further, while the map of Bengal has certainly taken me a long time, this was because I had still to determine what seemed to be the best methods. Having done so, there can be no doubt that application to other areas should give, in far shorter time, even better results.

While the full explanation of the relative value to agriculture of Old and New Alluvium at either end of the Ganges plain must await adequate topographical and soil surveys and their comparison, the conditions of hydrography and rainfall, and of slope and nature of dissection, are immensely important, and I look forward to applying some of the methods I have described to this problem. Finally I should like to express my appreciation of Mr. Williamson's dot map.

Mr. O'Dell queries my statement that it is possible to retain complete arithmetical accuracy (viz. that given by census figures of population and area) and at the same time combine it with geographical truth; but I trust that examination of the formula to be printed at the end of the paper will show that to be true. Urban population (shown by circles) should be added to the black of the actual urban sites in printing a coloured map of rural and urban density, and similarly for population change; in actual practice it is convenient to keep them in manuscript on separate maps, which can be seen as one when superimposed on an illuminated glass-topped tracing table. The question of shading *versus* colour reminds us that the map-maker requires the collaboration of the oculist or psychologist. As to the use of black with colour, I do intend to keep this for urban sites (urban density) where the contrast with colour will suggest a significant difference. In colour mapping I think it is most helpful to use a series in the order of the spectrum; this is instantly grasped by the reader. Lastly, colours are required adequately to show two distributions on the same map, as in my MS. map of density and change combined (VIII on list).

Mr. O'Dell considers that a section or belt of thana densities across the Delta would reveal significant breaks in population density, and thereby permit of simplification of the problem and reduction in the number of layers. This is an interesting suggestion, but the following points should be borne in mind. Taking the Delta alone, as I endeavoured to point out, the gradual rise in average density from west to east of the Delta is diversified by a constant recurrence of difference in local density due to local habitat as we pass from levee to levee across the interfluves. It is as if a gradual ascent from west to east were diversified by a succession of roughly parallel ridges at right angles to the general slope and involving an alternation of ascents and minor descents. Even were it possible to note significant changes for the Delta, they might not be significant for the alluvial fans around it, nor for the highlands beyond these. In other words, if we are to discover and determine with an open mind the real limits of distributions under varying conditions, we must

do so by recording fine differences first and making our generalizations afterwards. Without this, we are in danger of bringing the personal element to bear at too early a stage. In conclusion, allow me to thank all who have aided me by discussion, including Mr. Hinks, who has already given me his suggestions.

The PRESIDENT: I wish it had been possible to continue this discussion among the experts. It has been most interesting and, I am sure, extremely valuable. Professor Fawcett and Mr. Williamson have been exceedingly illuminating in their comment, but for myself I fear I cannot profess to have any close knowledge of the subject. I can however realize what immense labour the paper represents on the part of Dr. Geddes, and I ask you to join me in thanking him very much indeed for coming here to address us.

REVIEWS

EUROPE

ENVIRONMENT AND NATION: Geographical factors in the cultural and political history of Europe. By GRIFFITH TAYLOR. *Toronto: The University of Toronto Press* (*London: Oxford University Press*), 1936. $9\frac{1}{2} \times 6$ *inches; 572 pages; maps and diagrams.* 17*s*

In a sense, Darwin is one of the founders of modern geography, for the essence of his thought is that life and environment make up one whole and cannot be discussed seriously apart. This vision has seized the imagination of many a student, and Professor Griffith Taylor is to be reckoned in that company. His present work follows upon one on Environment and Race, which dealt with the whole world, this one studies Europe under the title of Environment and Nation, and a third will take up Environment and Settlement. The author is no friend to the historical geographer that is content to answer the question "Where?" He persistently asks "Why?" and tries to show us the interplay of organism and environment. He has the merit of seeing how much environment may be changed in response to man's efforts; in this direction he shows an advance on Demolins and de Tourville. And the ingenuity of block diagrams and maps is a feature one appreciates keenly, though one wishes the publishers had been able to make better reproductions. Nevertheless one has to say very regretfully that, with all the enthusiasm and courage the book shows, it is not really a successful effort. The block diagrams and tables sometimes lead to abbreviated *dicta* which cannot but be unsatisfactory, as the author realizes when, on p. 24, dealing with Race, Religion, and Language the Magyars are placed in special association with the Poles. Nevertheless Professor Taylor is helpful in insisting on the concept of zones and strata in matters of interpretation. To him a population group is not a unit, but a complex of strata wherein successive physical racial complexes and successive cultural influences overlie one another. He is always ready to see in human affairs outliers and inliers, if one may borrow geological terms. Whether the story of humanity is as vital to him as it might be the reader may doubt. The moving picture of the lives of ordinary men and women throughout the ages meeting various problems in their diverse environments and working with many setbacks towards diverse solutions is something that must be set forth with subtle feeling and a sense of perspective as well as with the intimacy that Vidal de la Blache so notably developed.

After giving an introductory statement Griffith Taylor studies Britain, and then follows out Topography, Climate, Race, Language, and Early History in Europe, with a further sequence of chapters on Greece and Rome in Classical Times, the Folk Wandering, Religion, and the Renaissance. Having worked through this general section the author takes the countries of Europe one after another or sometimes in small groups. In each case he attempts a sketch of the physical, structural evolution of the region and leads on thence to its prehistoric and historic metamorphoses. He rightly argues that unity of language, religion, race (in the physical sense), tradition, governmental independence and the possession of a well-defined environment and a natural centre all contribute to the possibilities of nationhood. One may wonder whether race has much to do with this, but there is no doubt that he is right in urging that the absence of an obvious natural centre delayed the evolution of nationality among both the German

and the Italian-speaking peoples. At the same time he wisely quotes Professor Scott's plea that continued political association and defence against common foes are important factors of a common consciousness. There is need for much attention to the working of the mind if we are to understand the moving picture, and it may be that Professor Taylor would have got nearer to giving us what he obviously wants to give us had he emphasized political changes rather less and social evolution much more. Political arrangements, as he sees, are apt to be as transitory as Charlemagne's empire or the Treaty of Versailles (1919), unless they reflect social conditions, for we are basically social creatures, and it is the social structure and its perpetual adjustment that is the very core of the study of Man and Environment that looms so large in geography. The truth is so subtle that it is apt to slip out of the network of generalizations we make for it; we must not rely too much on graphic and tabular presentation, which is a help, but can only too easily suggest oversimplification. Read carefully and critically, 'Environment and Nation' can stimulate healthy disagreement in every chapter; it is a basis of discussion rather than a finished product, its diverse aspects need more interweaving, its many incidental statements call for pondering and adjustment. It touches so many things that the reader who does not know the author's personality might be tempted to think that all these facts and inferences are to him mainly the rough material for diagrams and maps. Some of us know that is not the case, and wish the author had found it possible to convey more of a personal vision through his book. H. J. F.

A STUDY OF INDUSTRIAL EDINBURGH AND THE SURROUNDING areas, 1923–1934. Volume I. By NORA MILNES. *London: P. S. King & Son*, 1936. $9 \times 5^{1}_{2}$ *inches;* viii + 270 *pages; diagrams.* 12*s* 6*d*

Miss Milnes in this first volume deals with the industries of Edinburgh and portions of West and East Lothians, *i.e.* the area covered by the Edinburgh Labour Exchanges, from 1922 to 1934. The volume stands in large measure as a separate unit, although it will be necessary to see the succeeding issue before the work as a whole can be finally assessed as an industrial study. The work is essentially based on the statistics of the various authorities, such as the Ministry of Labour, the Town Council, and the Registrar-General. The volume is divided into two parts, the first dealing with the general background and the second, and slightly greater portion, with special industries. These industries are transport, building, printing and paper trades, brewing, rubber, laundries, and coal-mining.

Miss Milnes, almost single-handed, has attempted in part to do for the relatively prosperous region of Edinburgh what has been done for London and the depressed areas by teams of workers. Therein lies both the strength and weakness of the study. Unity of aim and the knowledge gained by being compelled to handle the material alone gives value to the assessment of crude data, while against this must be set the impossibility of handling the mass of statistics save with a considerable time interval. House-to-house surveys are prohibited for the lone worker, and Miss Milnes has endeavoured to surmount this difficulty by interviews with employers and trade union officials. The City of Edinburgh is usually summed up as having as its main backbone of occupations the professional and administrative services. The work shows (*vide* Table I) that this is in large measure a misconception, for less than 10 per cent., even including clerical grades, are so employed and, while this is about double the figure for Glasgow, professional work is decreasing in the capital and increasing in Glasgow. The only industrial occupation group, apart from personal service and clerical work, to exceed 10 per cent. in the City of Edinburgh is that of the

transport workers, and the chapter in Part II which deals with this industry is one of the most interesting in the volume. Chart VI demonstrates vividly the rise of the road traffic and the decline of shipping, and docks, and the railway. In part the diagram, since it deals with numbers of insured workers, does not give the complete picture, but it does show how the effect of competition between the media of transport has affected the occupations of the people. The growth of the municipal and limited company traction services, 203 million journeys being made in 1933 as against 163 million in 1927, is in large measure of course not due to the decline of railway patronage in Edinburgh so much as to the vast lateral spread of the dormitory part of the city in recent years to areas not served by rail. With the rise of industries in the Edinburgh district Leith is likely to lose its "unbalanced" trade, whereby imports so greatly exceed exports by tonnage. The final chapter on coal reveals the prosperous state of the adjacent coalfields owing to the trade agreements with the Scandinavian countries. Mechanization of the workings, already high, would be further stimulated by amalgamations of the smaller companies on the lines of those that have taken place in Fifeshire.

Miss Milnes is to be congratulated on the presentation of her data, and the volume is useful not only for those interested in Edinburgh but for all who have interests in the depressed areas. This study enables one to see to what extent the depressed areas have been abnormally hit in the economic storm. The volume gains in value if it is read in conjunction with the articles on Scottish industries by C. A. Oakley, published in *Scotland*, issued by the Scottish Development Council and shortly to appear in volume form. A. C. O.

THE ARCHAEOLOGY OF SUSSEX. By E. Cecil Curwen. (The County Archaeologies. General Editor: T. D. Kendrick.) *London: Methuen & Co.*, 1937. $7\frac{1}{2} \times 5$ *inches;* xviii + 338 *pages; illustrations and maps.* 12*s* 6*d*

This volume, the eighth of the County Archaeologies, differs from its predecessors in some particulars: its price is 12*s* 6*d* instead of 10*s* 6*d*, it omits the useful feature of the Archaeological Gazetteer, seems to emphasize the appeal to "the general reader," and stopping short of the Saxon Conquest, and dealing somewhat perfunctorily with the Roman Occupation (25 out of 319 pages), it is practically a treatment of the prehistoric archaeology of the county. One may prefer the series proportioned as it was, and rather regret its transformation. However there was much reason for giving free rein to the idiosyncrasy of the author, whose practical experience and knowledge make him an authority in the prehistoric field. He has given us an admirable book on Sussex prehistory, and there is little in it we could dispense with, though in places he might have been more concise. Illustrations and distribution maps are apt and plentiful, and we find particularly useful a chronological chart (Fig. 1) of the relations of our prehistoric periods to phases of climate, cultural stages, and events in Mediterranean lands; and there are others equally welcome. Not only the general reader, but many experts or semi-experts in various branches will be glad of clear statements and summaries of recent knowledge, *e.g.* on neolithic pottery; indeed, the whole of the excellent chapters on the Dawn of Civilization, on Flint Work, and on Celtic Agriculture are most acceptable. In each of these departments the author has had the inspiration of definite excavational discovery and of careful co-ordination. Sussex tirelessly incites to the writing of books, but this one will stand out with lasting properties. We cannot follow the author into detail. There is little that he misses, but the list of bronze hoards should probably have included one found near Plummer's Plain, Lower Beeding, in 1864. S. E. W.

GRENOBLE: Étude de géographie urbaine. By RAOUL BLANCHARD. *Grenoble: Didier and Richard*, 1935 (3e Edition). 9×5½ *inches; 234 pages; illustrations, maps, and plans*

The first and second editions of this work appeared as early as 1911. In the present edition the author has been able to include reference to much recent research concerning the actual site and the historical development of the town. Chapter III, for example, includes a detailed account of the regularization of the Isère and Drac in the neighbourhood of the confluence of those rivers, and of the conditions which made necessary the diversion of the Drac. The coarse alluvium brought down by the still juvenile Drac was responsible for thrusting the Isère against the northern wall of the valley, thus confining its multiple waters to a single channel and providing the site for a bridge. Herein the author finds the key to the origin and development of Grenoble as a bridge-route town, at the convergence of Isère, Drac and Romanche valleys, on the routes between Vienne and the Genèvre and Lauteret passes. A place of but little account in the early Middle Ages, Grenoble developed rapidly during the thirteenth and fourteenth centuries; but its position on a frontier route spelled disaster in succeeding centuries, and the author shows the unhappy town in the mid-sixteenth century as hardly more advanced than in Roman times. A series of plans and photographs admirably illustrate the gradual expansion of the town and the shift of its centre of gravity westwards, from the water-logged silt of the Isère to the higher and drier gravels of the Drac.

In chapter VII the author sketches the industrial history of the town, discussing, in particular, the glove industry, which, in spite of many vicissitudes, has remained dominant, although retaining the characteristics of a mountain industry. The book is brought to an end by a brief consideration of Grenoble as a regional capital, a rôle which it might have fulfilled much more completely but for the competition of Lyons.

Interesting though the correlation of economic development and geographical conditions is shown to be in the instance of Grenoble, the author leaves us with the impression that the development of a town of 100,000 inhabitants in the heart of the Alps is due as much to human enterprise as to natural advantages.

H. O.

PÅ SKIDOR OCH TILL HÄST I VATNAJÖKULLS RIKE. By HANS W:SON AHLMANN. *Stockholm: P. A. Norstedt & Söner*, 1936. 9½×6½ *inches; 204 pages; illustrations and map. Kr.11*

This is an account of the Swedish-Icelandic expedition, in the spring of last year, to Vatnajökull, followed by a description of the author's travels in Austur Skaftafelssýsla. Although we are told in the introduction that it is "only a simple narrative containing hardly anything of a learned nature," Professor Ahlmann's book is something more than a mere story of travel and adventure. It gives—rather summarily, it is true—some of the glaciological results of research carried out on a most important glacier: "Vatnajökull is not only Europe's largest glacier; it is probably the most extensive coherent mass of ice outside polar regions. Its area is 8700 square kilometres, and it is therefore ten times the size of the biggest glacier on the European continent, Jestedalsbræen in Norway."

Moreover the fact that such scientific data as the book contains were obtained under exceptionally favourable conditions enhances their value: "The time for an expedition of this kind could hardly have been better chosen. . . . In the spring of 1934 the Grimsvötn-Sviagidur volcano situated under the ice had been in eruption, covering the whole of Vatnajökull with a thick layer of

black ashes which would be of invaluable assistance to us in the task of identifying the snow masses which have since accumulated over the ice." The data in question will mainly be found in the short study on Vatnajökull, and glaciers in general, written for the special benefit of those interested in the scientific side of the expedition; but the details given in the narrative itself regarding the equipment of Professor Ahlmann's party, their food supplies, and their means of transport will doubtless likewise interest experts. Hitherto, horses have been considered the best, if not the only, means of transport in the regions visited by the expedition; but while the author praises the famous Icelandic ponies "which climb like goats," he gives preference to dogs and declares that without these he would never have been able to reach his goal and return safely. In this connection it is interesting to note that the man who had led the Swedish-Norwegian arctic expedition to North-East Land in 1931, and had also been one of the leaders of the Norwegian-Swedish Spitzbergen expedition three years later, felt at the outset that Vatnajökull was going to be "the hardest nut to crack." His apprehensions seem to have been well founded: perilous indeed was the way, numerous were the difficulties to be overcome, and very real the hardships to be endured.

The chapters dealing with Austur Skaftafellssýsla are perhaps those which will appeal most to the ordinary reader. In this part of the book wild scenery of imposing grandeur, "unique even for Iceland," is unfolded before us, and we are given an insight into the patriarchal family life of a hardy people for ever engaged in a struggle against a relentless Nature. One is apt to think of the Icelander merely in terms of the ancient sagas, and on this the author remarks: "It will be readily understood that a modern Icelander striving after the material and cultural development of his country is tired of the everlasting talk about 'sagoön,' and is, above all, irritated by the romantic representation, propagated in Germany, of Iceland as the cradle of the pure Germanic race, where are still to be found descendants of the vikings . . . whose stock has not been tainted with foreign blood. The modern Icelander is mainly concerned with his own era and Iceland of to-day; he is inclined to exaggerate the Celtic element in his race, and he desires complete independence for himself and his country." Nevertheless, Iceland, home of the "Eddas," where ancient traditions and strange superstitions still linger, where the vernacular remains practically unchanged as the centuries flow by, possesses a romantic charm all its own, and Professor Ahlmann's book is redolent of that charm. The numerous beautiful photographs which it contains help to make it attractive. F. M. M.

BORDERLANDS OF LANGUAGE IN EUROPE, and their relation to the historic frontier of Christendom. By VAUGHAN CORNISH. *London: Sifton Praed & Co.*, 1936. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* viii + 106 *pages; maps.* 6*s*

Dr. Vaughan Cornish states in the Preface that, after examining the history of more than thirty polyglot provinces, he has found that they occupy a position where the frontier of Christianity remained stationary for a considerable time. More explicitly it is stated (on the cover) that " the dual language of these districts did not originate in oppressive encroachments by [a] stronger neighbour, but in the conditions which obtained when the area in question was situated on the frontier which separated the Christian from the heathen or the Mohammedan." Thereupon the author launches into a recital of the dates and facts of border history, from Flanders to Karelia, dealing with geographical, racial, and ecclesiastical factors, and occasionally turning to geological matters as well. His account is not always free from historical errors (it is not correct to speak of the Holy Roman Empire being *constituted* in 962 (p. 14)) and he

does not pay too much attention to his thesis, making no attempt to summarize the results of his examination. Perhaps this is as well. To link polyglottism with a halt in the advance of Christianity is misleading. The progress of Christianity may indicate the course of colonization or penetration, as the author shows clearly to have been the case in East Galicia; on the other hand, in Rhaetia the Bavarians were not converted until two centuries after their occupation of the province. The crusading spirit may on occasion have provided an excuse for colonization, as the conquest of East Prussia by the Teutonic Knights (not stressed by Dr. Cornish) shows. But there is no evidence that the advancement of Christianity was the motive underlying folk movements after the fall of the Roman Empire (sometimes, as in the case of the Szeklers, Dr. Cornish acknowledges that it was not); and unless it can be shown to have been this, it is difficult to see what is the "importance of the Ecclesiastical Map of the Dark and Middle Ages for an understanding of the national and political geography of modern Europe." Indeed the author, by the stress he lays on physical geography (and here his sketches hardly form a satisfactory substitute for maps), seems tacitly to admit that in most cases this was the determining factor. J. P. H. M.

ASIA

EUPHRATES EXILE. By A. D. MACDONALD. *London: G. Bell & Sons, 1936. 7½×5 inches; 302 pages; illustrations and sketch-map. 7s 6d*

The author of this book endeavours to present a picture of Iraq as it is to-day by a detailed description of a series of incidents and personal experiences. It displays qualities of observation and analysis, but the perspective of the resulting picture is marred by the method of presentment. The series of pen pictures lacks connection or consecutiveness. A description of Badawin life is followed by a dissertation on the alleged evils of a sense of national prestige among British officials, and then jumps to the loss of an Assyrian servant who feels homesick in the district of the Lower Euphrates. The same lack of continuity characterizes the remainder of what the author describes as "Sketches." The presentment is distinctly impressionistic, which is not necessarily a fault, but is apt to become one when the writer is frankly pessimistic in outlook and tends naturally to a destructive form of criticism. This outlook is reflected in the choice of incidents depicted. Under the heading "Robbery" the Arab is portrayed as a callous individual lacking in courage or any sense of family affection. The incident described may be true enough, but any one with experience of the country could cite a dozen happenings to prove the contrary. A similar method applied to life in England could provide as depressing a picture of the English. The same criticism applies to the diatribes against the supposed bureaucratism and hide-bound outlook of the Anglo-Indian contained in the sketches "Anglo-Indian Aesthetics" and "Abstinence." How many examples could be quoted to show that the present-day Englishman in India is not the sun-baked bureaucrat of fiction, if indeed he ever was.

To many of the sketches and the deductions which the reader is asked to make obvious replies suggest themselves. Under "Strategic Considerations" the author, in a mood of introspection, asks himself whether as a member of the R.A.F. organization in Iraq he is giving the British taxpayer his money's worth, on the grounds that it is difficult to find any strategic justification for the retention of the Air Force in Iraq. A consideration of this question entails a study of the whole history of the Iraq problem. Of all the post-war settlements it may be said to have proved the most successful. Apart however from this success, it can be argued that the squadrons now in Iraq have to be maintained some-

where, and a better training ground would be difficult to find. Under the heading "Domesticity" the writer refers to the "hundreds of thousands of Englishwomen scattered between Alexandria and Hongkong who wage an unending war against the tide of boredom . . . or who tread out the best years of their life in an atmosphere of unbelievable futility." No reference is made to the Englishwomen who have successfully raised families in the East, and who have found it neither boredom nor futility.

The book is interesting in that it treats of the problem of the new relationship arising from the conception of trusteeship which has been brought into prominence since the mandatory principle was established. The conclusions arrived at are thoroughly pessimistic. The chapter "Hatred" leaves the impression that the predominant relationship between the Iraqi and the Britisher is one of hatred. The writer states that he has never met an Iraqi whose feelings for the British contain any emotion which a spirit of alliance might be expected to evoke. If this is really the case, and applies to other countries besides Iraq, it is a depressing augury for the solution of the problems that face us, especially in India. It is however one which the majority of Englishmen with Eastern experience will deny.

On p. 165 the author refers to the survival of those old acceptances on which was built the spirit of predatory imperialism. The existence of some grounds for such an accusation is admitted, but at the same time it is equally evident that the spirit of the times is changing. The class of young man now going out East would deny indignantly that they were actuated by any tradition of predatory imperialism. It is the young generation in India that now criticizes their seniors for not moving with the times. E. N.

SOUTHERN INDIA: Its political and economic problems. By GILBERT SLATER. *London: George Allen and Unwin*, 1936. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 384 *pages; illustrations.* 15*s*

This book is a record of visits made by the author to many parts of South India and to a few other places while he was Professor of Indian Economics at Madras, and of his activities as Publicity Officer to the Madras Government. Informal, and at times discursive, it is a useful, if unusual, commentary on many of the economic problems of the Indian people. Dr. Slater went to the heart of things when he advocated, with success, surveys of the life in, and activities of, the Indian village. Among the many topics with which he deals are the planting of cotton, the building of wells, relations between the different communities and castes, the means of transport, the standard of living, and public health. Indeed few matters escaped his notice, and his shrewd and practical remarks are directed impartially to administration and to economics. His concluding chapter, which discusses briefly the future of India, would have been more convincing if he had shown a greater appreciation of the problems of Indian defence, and his unfair remarks about Lord Londonderry might well have been omitted. It is however unfortunate that his figures are often very much out of date, and it is difficult to understand why he nearly always uses the 1921 census. Thus it is no longer true that "Kumbakonam is the largest town in the Tanjore delta, slightly exceeding the old Tanjore." The population of the towns in 1931 was 62,317 and 66,889 respectively. The figure given for Madura is incorrect by nearly 45,000. The area of Cochin is incorrectly given, and the density of population in 1921 was 662 to the square mile, not 690, as stated. But the position is now more serious, for by 1931 the density had risen to 814 to the square mile and the total population was 1,205,016. Despite these defects, the book gives an admirable picture of the Indian peasantry and the author's obvious sympathy

with their needs and his skilful presentation of their difficulties should convince his readers of the gravity and urgency of a major Imperial problem. J. N. L.B.

LES BATAILLES POUR L'HIMALAYA, 1783–1936. By CLAIRE-ELIANE ENGEL. (La vie en montagne. Edited by JACQUES DIETERLEN.) *Paris: Flammarion*, 1936. $8\frac{1}{2} \times 6$ *inches;* 158 *pages; illustrations and maps.* 12*fr.*

In this small volume Mlle Engel has skilfully accomplished that most difficult task, the summary of many expeditions from first-hand sources, without destroying the interest of the original documents. To give a clear, succinct account of even one expedition to a distant land, without overloading the narrative with topographical detail, is always an awkward task. Mlle Engel has a breadth of knowledge and outlook which enables her to fasten the reader's attention on such details as are of importance, and the map-drawings supply a background in the simplest and most intelligible form; while for those who wish to study the originals further, there is a well-selected bibliography printed at the end.

The three introductory chapters bring one to the turning-point in Himalayan exploration, when Graham, Conway, and Bruce enter the scene. From this point the story moves steadily forward from what was first more strictly travel to the era of modern mountaineering, the last chapter describing the first organized French expedition to the Karakoram in 1936. It is notable that, while Mlle Engel recognizes the national characteristics which mark the differences between expeditions from one European country and those from another, there is no hint of international rivalry other than a sporting acknowledgment that a peak may well be regarded as the preserve of that nation which first attempted its conquest.

The authoress has rightly laid emphasis on one new development of modern mountain exploration, the coming of the film. The disastrous result of its misuse in the 1934 Karakoram expedition, with the clash of interest between mountaineer and film magnate, is contrasted with the brilliant pictures brought back from other modern expeditions. It is not merely a question of tickling the palate of sensation lovers; the film has become an important element in spreading the knowledge of exploration and in stimulating public interest, and Mlle Engel is wise in adding comments on the films to her narrative of events.

The book is written in a terse, lively manner, and although both subject and district must necessarily change from chapter to chapter, one never loses the sense of continuity. There are a few mistakes of detail or in the spelling of names; for instance, Mummery's expedition is placed one year too early, and in describing the 1934 Nanga Parbat expedition there is some confusion with the various camps; and it was Merkl, not Wieland, who shared with Welzenbach the 60-hour bivouac snowbound on the Grands Charmoz.

Mlle Engel is to be congratulated for the excellence of her story, which should go far to arouse the interest of her compatriots in Himalayan exploration. H. E. G. T.

AFRICA

LE DELTA DU NIL: Étude de géographie humaine. By JEAN LOZACH. (Publications de la Société Royale de Géographie d'Égypte.) *Le Caire: E. and R. Schindler*, 1935. $10 \times 6\frac{1}{2}$ *inches;* xxiv + 304 *pages; illustrations and maps.* 8*s* 6*d.* [*London: Quaritch*]

This important work by the joint author of 'L'habitat rural en Égypte' is an attempt to fill a gap in the geographical literature on Lower Egypt by synthesising data concerning the human geography of the modern Nile Delta, which

includes two-thirds of the useful surface of Egypt and a rural population of nearly seven millions. The study is essentially of rural Egypt, consequently Alexandria and Cairo are not considered, neither is the Suez Canal. Further, as the study is specifically human geography, physical geography is introduced only in so far as is necessary to give a correct general conception of the physical setting.

The work is based on observations and inquiries of competent persons within the different social classes, made during numerous journeys in the field; on published material which previously has been unco-ordinated; and on unpublished monographs on their native village or locality by students of the Faculty of Law and of the High School of Commerce, Cairo.

Generally, historical references in the body of the work do not go beyond the French expedition of 1798, which marked the beginning of the modern era in Egypt, and which shortly after set down in its magnificent *Description* so much precious information concerning the Egypt of that time; but an introductory summary of the earlier history of Lower Egypt is given.

M. Lozach studies the human adjustments to the physical environment as they were at the time of the *Description*, *i.e.* early nineteenth century, the changes that have taken place since then, and the conditions as they are to-day. In Part I there is a detailed discussion of agriculture, and of means of transport, while Part II is a detailed presentation of conditions in the two major regions into which the delta can be divided, *i.e.* in the South, the High delta which, under the basin régime, was regularly submerged for thousands of years until the nineteenth century, and, in the North, the Low delta, which is a purely deltaic region formed by the uncontrolled work of the river, and which was left uncultivated for many centuries.

In his conclusion the author discusses very briefly the general effects of the rapid increase in population, and of the recent world economic crisis which has affected Egypt no less than most other countries. He foresees a rapid change from the cultivation of cotton, which has dominated the life of the delta for the last seventy years, to the production of a greater variety of food and industrial crops, to an extension of the area under cultivation, and to a rapid development of manufacturing industry which will draw its raw materials from Egypt's own soil.

The work contains a comprehensive bibliography of one hundred and sixty-five items. There are also two coloured maps on the scale 1:500,000, one a general topographic map, and the other a partially original map showing grouping of habitations in the Nile delta. In addition there are, in the text, several maps of smaller areas, and a number of useful photographic illustrations.

W. F.

THREE DESERTS. By C. S. JARVIS. *London: John Murray* (1936). $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* x+314 *pages; illustrations, sketches and map on end-papers.* 10s 6d

The publication of this book closely coincided with the termination of the author's twenty-odd years of service in the deserts of Egypt, where for many years he has been Governor of Sinai.

The first desert of the three is the coastal strip west of Alexandria. Here Major Jarvis was stationed during the war, when a non-existent Senussi menace occupied the attention of numerous British troops. Hither also he returned as an officer of the Egyptian Frontier Administration. During this period came the 1919 rebellion, and we are given a graphic description of it.

The second desert is that of Kharga Oasis, 400 miles farther south. Here in a true oasis atmosphere of extreme isolation, extreme poverty, the petty

squabbles of the natives and clouds of mosquitoes, the Jarvises proceed to make an English home with dairy farm, home-grown hams, vegetable gardens, and snipe shooting.

The last half of the book is about Sinai, the third desert. Here again we learn how to make the best of things in a lonely desert outpost. There are lovely chapters about desert gardening and about the companionship of dogs. There is a thrilling description of a war, carried on for months with troops, flame-throwers, and poison to protect Egypt against a major invasion of the country by locusts.

The book is simply and directly written, and maintains that humour and lightness of touch for which the author is already well known. He makes us chuckle at Egyptian officialdom as neatly as Evelyn Cecil did; but we get more besides—a first-class picture of the lives and mentality of the subjects over whom the author ruled for so long. R. A. B.

AFRIKAFAHRT: eine Frau bei den Negern Westafrikas. By EMMY BERNATZIK. *Wien: L. W. Seidel & Sohn*, 1936. 9×6 *inches; 240 pages; illustrations and route-map. RM.5.50 (unbound RM.4)*

In this attractive book the author describes a journey undertaken by herself, her husband, and Professor Struck to West Africa to make an ethnographical survey of the coastal tribes of Portuguese Guinea, a people who are said to have penetrated thence from the Sudan. The expedition landed at Bissau, an ancient Portuguese port, and travelled through the districts of Balante, Biafaden, Pepel, Mandyak, Sudbayot, and among the Bissagos islands, collecting a wealth of information on the customs, dress, and religion of the tribes that have so far escaped the doubtful advantages of Western civilization. The author has some scathing remarks to make on the effect of missionary effort and European culture on the native mind. Among the 101 illustrations there are some exceptionally successful photographs, particularly those in which the movement of dancers has been caught by the camera. One picture (p. 59), which is of special interest to the reviewer, shows the hair dressing of a small boy in which the head is shaved on both sides leaving a narrow band of hair in the centre of the crown from the forehead to the back of the head. An exactly similar custom for small boys is followed by the Amhara tribe in Abyssinia, and Mr. Bertram Thomas records it in the Shahara and Kathiri tribes in Southern Arabia. In Abyssinia, and probably in the other cases, it is believed to be a means of averting the evil eye. R. E. C.

REVISITING MY PYGMY HOSTS. By PAUL SCHEBESTA. Translated from the German by GERALD GRIFFIN. *London: Hutchinson & Co.* [1937]. $9\frac{1}{2}$×6 *inches; 288 pages; illustrations and map. 18s*

In this book Father Schebesta gives an account of his latest journey amongst the Congo pygmies. On this occasion he approached them from the east coast of Africa, in order to complete the study which he had begun in 1929–1930, and about which he has written in 'Among Congo Pygmies.' The book is not so much a supplement to the former as a study of the Bambuti, the term used by the author to describe all the pygmies of the Ituri forest, and is the result of greater experience and knowledge of them.

The book is not entirely satisfying. Father Schebesta has certainly added to our knowledge of these people, but there are still many gaps to be filled in. The evidence collected in this book should prove invaluable as a basis for further study. Mention is made of legends which represent the pygmy as the benefactor of the negro, not only by introducing him to the banana, but also by

teaching him all about the breeding of livestock, yet the pygmy does not cultivate bananas nor does he breed hunting-dogs, both being now obtained from the negro. In the chapter on Pygmy Theology there is an interesting note on *Megbe* (p. 187), a living magic power which can be transmitted by a dying person to his eldest son through his mouth, and also acts as a link between the totem animal and the members of the clan (p. 200), and one wonders whether inanimate objects are capable of possessing *Megbe* also. Then there is the story of Masupa, God the Creator; one of his sons, whom he created, being the ancestor of the pygmies, and the other, that of the negroes. Masupa himself, apparently, was a blacksmith. The author thinks that the conception of the Deity as a creator-God was formerly much more definite in the minds of the pygmies, and has only become dimmed by other beings very gradually.

Father Schebesta draws a very interesting picture of the interdependence of the pygmy and the negro; each negro chief is patron or lord of a pygmy group, one providing the fruits of agriculture, spears and arrows, the other meat and ivory; but the need of the pygmy for the negro is stronger than the need of the negro for the pygmy, and the negro becomes the master. He formulates a plan to save the pygmy from gradual extinction which might easily be put into effect, and one hopes that now he has aired the subject his plan may receive some attention.

The photography is good. There are a few rather obvious errors among which are the spelling of some place-names, etc., and the translator, who has done his work extremely well, has been unfortunate when he falls into unsuspected traps: whatever one may call the plant which produces the banana, it certainly cannot be described as a "bush," nor is a pawpaw a melon. The index is inadequate. It is only fair to add that this book will certainly give a considerable amount of pleasure to a large number of readers. E. B. H.

NORTH AMERICA

SETTLEMENT AND THE FOREST FRONTIER IN EASTERN Canada. By A. R. M. Lower. Settlement and the mining frontier. By Harold A. Innis. (Canadian Frontiers of Settlement. Edited by W. A. Mackintosh and W. L. G. Joerg. Vol. IX.) *Toronto [and London]: The Macmillan Company*, 1936. 10×6½ *inches;* xiv+424 *pages; illustrations and maps.* 17*s*

Surely in no considerable country in the world are continuous areas of farming population so physically divorced as in Canada. The Laurentian Shield thrusts a broad wedge between the wheatlands of the west and the narrow occupied belt of the St. Lawrence lowlands; and these two widely separate areas are themselves limited to the north, the one by forest and forest soils, and the other by the southern rim of the Shield itself. So effective is this great negative area that even to-day one cannot motor from eastern to western Canada without entering the United States. Even that southern peninsula of the Shield which lies between the occupied Ottawa valley and the farming country north of lake Ontario still resists settlement, though proximity to populous areas is making of it a kind of recreational camp. The present volume in this important series deals with the sporadic oases of settlement on the Shield itself, in the Cordilleran province of British Columbia, and in the Yukon.

The Shield exhibits a less repellent character in many minor and in some major areas. Where marine or lacustrine sediments, as in the tectonic depression about Lake St. John, or again in the basin of glacial Lake Ojibway, have ameliorated the usual negative characteristics, farming, after clearing, becomes

a possibility. The growing season is short, the winter severe, and the autumn rainfall excessive; yet summer sunshine is prolonged, grasses, oats, potatoes, and other vegetables do well, and dairy cattle can be kept.

The first part of this volume deals with the relationships between farming and the forest industries in these areas. At first sight one might have supposed that the two were conveniently complementary. The cutting is a winter operation, and the men could return to their farms in the spring. In the earlier days of purely lumber operations this no doubt was usually the case, but the great paper and pulp mills, heavily capitalized, less ephemeral than the saw mill, and working throughout the year, tend to attract the young men permanently from the farm. Much alleged settlement has proved, in fact, and in defiance of regulations, a mere temporary holding until the timber could be sold. Further, the paper and mining towns alike, with improved communications, come to rely more on the standardized farm products of older and often distant areas than upon the uncertain local farming. A certain diversity of interest, as between the pioneer farmer and the forest industrialist, emerges as the main theme of this first half of the book, but one varied by differences in Government control and racial tradition as exemplified in Ontario and Quebec.

The second part comprises what is essentially a series of essays on the economic history of mining in Canada, with some emphasis upon the regional characteristics of the industry in widely separate areas. Thus the account of the Yukon developments, from the gold rush of the 'nineties to the present day, illustrates the ephemeral nature of the original hand-worked claims, and the growing necessity for capitalist enterprise in dealing with sluicing operations and with the terrace gravels; in the initiation of dredging; in the development of hydro-electric power; and in the installation of railway communication, the last suffering from particularly high freight rates because of the realized instability of placer mining.

Then the mining of metallic ores of fair accessibility in the Kootenay district is contrasted, in late chapters, with the costly development of mining of the precious metals on the Laurentian Shield. The effect of these industries upon the development of transport and local farming is emphasized. In many parts of the world such development has stimulated farming and industrial activities, near the mining areas, which have outlasted the stimulus of the mining itself. The physical environment of many of these Canadian mining districts is little favourable to such an evolution.

The bias in this, as in the other volumes of this series, is towards economic and social development. There is little formal geographical treatment. Nevertheless there is much detailed material of interest to the student of economic geography. LL. R. J.

LANDNAHME UND KOLONIZATION IN CANADA, am Beispiel Südontarios. By CARL SCHOTT. (Schr. Geogr. Inst. Univ. Kiel. Band VI.) *Kiel*, 1936. $9\frac{1}{2} \times 6\frac{1}{2}$ *inches;* xvi+330 *pages; illustrations and maps. M.*12

The area covered by Dr. Schott in this work is Southern Ontario, and by Southern Ontario he means not merely the drift-covered area of Palaeozoic sedimentaries, but also the southern edge of the Canadian Shield as far north as the Ottawa River, Lake Nipissing and westwards from there to Georgian Bay. In this area his investigation and exposition of colonization and land settlement are oriented with reference to his conception of what constitutes the geography of such a topic. Briefly his position seems to be that the geographer is concerned with a study and interpretation of existing landscape, that this landscape includes the natural "groundwork" and the human modifications thereof,

and that the only satisfying method of getting to understand this landscape is to trace its development to its actual condition. The present work, then, is essentially an evolutionary study. It commences with the physical foundations and gives a short, but good, account of the structure and relief of the area, with an unusual, but justifiable, amount of attention to the nature and effects of the Quaternary glaciation. To this the author adds a concise account of the climate, and in the light of these two sections devotes a relatively large amount of space to the nature and distribution of the natural vegetation. From documentary evidence he reconstructs the *urwald* as it existed about the end of the eighteenth century, and that completes his picture of the natural conditions in which the colonists had to work. The rest of the work is devoted to their plans and performances, always however with an eye to the changes they were making in the face of the country. This is the major part of the book, comprising about four-fifths of the total text space, and hardly a conceivable aspect of the progress of settlement is omitted. It divides into two approximately equal parts, the first devoted to the pioneer age, which the author considers to have ended over most of the area by about the middle of the nineteenth century, and the second to the evolution of the present landscape out of the pioneer landscape. The following topics of investigation in the first part will serve as indications of the comprehensive view Dr. Schott takes of his task: immigration; population increase and distribution; governmental land policies and legislation; survey systems (which defined the lay-out of settlements); private colonization schemes (the Canada Company, for example); primitive pioneer agriculture and its development; communications; the growth and pattern of towns. The treatment of the second period is no less thorough. How wide a net has been thrown may be gathered from the bibliography (classified) of 673 items—including Rolf Connor, 'The Man from Glengarry'; and Stephen Leacock, 'Sunshine Sketches of a Little Town.' Among the appendices is a collection of 55 views, aptly chosen and well reproduced. Students, whether of Canadian geography or of contemporary German geographical concepts and methods, should find it of great value. R. O. B.

ATLAS OF AMERICAN AGRICULTURE. Physical basis, including land relief, climate, soils, and natural vegetation of the United States. Prepared under the supervision of O. E. Baker, Bureau of Agricultural Economics. 19×14 *inches*. *Washington: United States Department of Agriculture*, 1936. [$17]

The original plan for the 'Atlas of American Agriculture' included not only the physical basis but also sections relating to crops, livestock, farms and rural population. Sections on Cotton (1918) and Rural Population (1919) were actually published in advance sheets, but it was then decided to restrict the scope of the atlas to the more or less permanent physical conditions which require coloured maps for their portrayal. The other material which had been accumulated has been published in a series of articles in the Yearbooks of the Department of Agriculture from 1921 and 1925 and in the Graphic Summary of American Agriculture. The Atlas as now finally published consists of four very unequal parts—on land relief, climate, soils, and natural vegetation. The whole has been prepared under the direction of O. E. Baker, whose influence in the progress both of geography and agriculture is already enormous.

The section on Land Relief includes one coloured map and two pages of textual explanation, by F. J. Marschner. This may be described as the first tolerably accurate relief map of the whole United States, and was prepared and printed in 1915, but has been known only to a privileged few who received

private copies. It is layer-coloured, with contours at 100, 500, 1000, 2000, 4000, 6000, 8000, 10,000, and 12,000 feet, and at the same time is lightly hachured. The result is not very pleasing.

The section on Climate is in three parts—temperature, sunshine and wind, by J. B. Kincer (1928); frost and the growing season, by W. S. Reed (1918); precipitation and humidity, by J. B. Kincer (1922). Through the earlier issue of the separate parts this comprehensive treatment of the climate of the United States is already well known and additions have not been made. Thus the temperature records analysed are up to 1922. The inset maps showing the highest and lowest temperatures "ever recorded" could be extended even in the reviewer's experience. Those who are apt to exaggerate temperatures may note that the mercury has never reached 115° F. except in certain limited areas of California and Arizona, but has fallen below −60° F. in Montana and North Dakota. On the other hand Southern Florida has never known a temperature of freezing.

The section on Soils occupies more than half the Atlas, and is the *magnum opus* of Dr. C. F. Marbut, issued in July 1935, only a few weeks before the tragic death of the author on his way from the Oxford Soil Congress to Manchuria. It is a work the importance of which it is difficult to exaggerate, and includes a complete soil map of the United States in 12 sections. At the same time Dr. Marbut has used all the material collected by the Soil Survey since its foundation in 1899, as well as his own unrivalled theoretical and practical knowledge, to present a reasoned account linking the American system of soil series with the international soil groups. Thus the map of the great soil groups (soil provinces) distinguishes eight main groups: (1) podsols, (2) grey-brown podsolic soils, (3) red and yellow soils, (4) prairie soils (northern and southern), (5) chernozems (northern and southern), (6) dark-brown soils (northern and southern), (7) brown soils, (8) grey desert soils (northern and southern). Outside this scheme are the Pacific valley soils, mountainous areas and the sandhills of Nebraska. The colour scheme on the larger-scale maps is arranged to accord with this main grouping. It should be possible now to link British soils with the American series, and the distribution of types under comparable climatic conditions in the State of Washington suggests that the non-podsols of Britain will find their equivalents in the grey-brown podsolic group. The comprehensive text of the soil section includes chemical and mechanical analyses by horizons of a large number of types.

The section on Natural Vegetation, by H. L. Shantz and Raphael Zon, was issued in 1924 and is already well known. The text includes 60 valuable photographs of vegetation types, but the present reprinting, apparently by a photogravure process, compares unfavourably with the original. L. D. S.

AUSTRALASIA AND PACIFIC

SAVAGE CIVILIZATION. By TOM HARRISSON. *London: Victor Gollancz, 1937. 9 × 5½ inches; 462 pages; illustrations and maps.* 16*s*

It is not possible, by way of review, to do justice to this book. In one sense it is an interesting and vigorous study of ritual life in the New Hebrides. No words are wasted—the language is incisive and gripping, and it is only by laying the book aside that one comes back to reality. In another and more forceful sense it is an uncomfortably realistic study, in rather a distressing form, of the dire consequences of the earlier so-called " white civilization" upon the New Hebrideans—the illegal operation of whites, the ruthless exploitation, with guns, drink, raids and "blackbirding," and of wars and pestilence. It is not a

book for the squeamish. It will shock the idealist and subdue the incredulous. Mr. Harrisson describes his work as a story not of "decadence or despair but of inevitability; with oases in chaos." His readers are left to draw their "own morals and comparisons," but it is doubtful whether, after reading the book, many would covet the Seat of Judgment for that unenviable task. The book will doubtless have critics, but criticism will be of style rather than of substance. The arrangement of the author's matter is unorthodox but fittingly so, for it is an unorthodox book. The segregation of periods and the grouping of incidents and events into "books" or chapters is most effective, as is also the "clipped" language of the summary with which each chapter is prefaced. Mr. Harrisson mentions that it had been agreed unanimously that the prose style in which the book is written "is at times unsatisfactory—unpolished," but he points out that, although a number of modifications were made in deference to those opinions, he " kept the pattern of words to fit the pattern in fact—angular fact": a wise decision upon which he is to be congratulated, for he resisted the temptation, which unique opportunity provided, of weaving a fascinating fabric of words, and concentrated instead on expressing facts in a form which left no doubt as to meaning and in a sequence which, to him, appeared logical. To understand fully how Mr. Harrisson was able to penetrate so deeply and to record so faithfully the kaleidoscopic panorama of New Hebridean life, one must appreciate that he "went native" thoroughly—mentally and physically.

The opening "book" or chapter is in two parts, the first of which is in the nature of geographic meditation from the top of Tabwemasana—a 6196 feet mountain in the New Hebrides group. The second part is an outline of pre-European tribal life in north-west Malekula—the necessary foundation to the narrative that follows. Here, under the influence of a "climate that is static and levelling " and amid "a culture that is not," the author is at his best, for his description of black-skinned woolly-haired natives—a numerous people, "all of one race with one broad pattern of feeling, agriculture, stone adzes, masculine war, the fear of dissatisfied death, the urge to climb higher," is a remarkable and valuable anthropological study based on experience of many months of "seeing, doing and hearing." These people fought and danced and, against the ever-encroaching jungle, struggled to cultivate their yams and taros, the palm for their huts and the coconut for their drink. They were not happy nor were they unhappy: their system worked. Then, in 1606, came the Spanish galleons of Don Pedro Quiros, the first contact of Black with White. What thought the Blacks of their coming? "These unfamiliar people, whom they had welcomed as supernatural, turned out to be not only sudden, unaccountable butchers . . . but also treacherous thieves, men who mutilated corpses and even broke the rules of war so far as to kill a chief." Fifty days of bloody incident, forays, decoys and killings, and Quiros set sail on what is described as "that incredible uncharted journey to Spain." For a century and a half the whites left those islands alone. Other great and intrepid explorers came, over thousands of miles of ocean, in long seaworthy canoes—some of them holding a hundred or more dusky-skinned men. " They made wind and tide charts with grass blades and sticks; had a coconut sextant and much astronomical lore and nomenclature." They brought with them also the highest conception those seas had ever known: belief in a benign creator, beautiful scarlet mats, new and more intricate dances, stone rites and sacrifices.

Mr. Harrisson then concentrates on the era which began when the next whites, Bougainville (1768) and Captain James Cook (1774), appeared on the scene. That era he describes as "one hundred and fifty savage years—a chaotic chain of events in a chaotic chain of islands." Bougainville and Cook were

followed by others—less scrupulous, and by 1830 schooners manned by the riff-raff of the Pacific were drifting into the group—"the pageant of death prospered exceedingly." The discovery of sandalwood, on one of the southerly islands, was the beginning of the downfall of the New Hebrides. Prices for this "sweet-smelling" commodity were high: there was a big demand for it and an abundance to be had for the taking. Vigorous and vicious exploitation followed, and thus, within twenty years, saw the passing of the stone age and the coming of the "gun-age." Two sub-chapters, entitled "Christ in Chaos" and "South Sea Saintliness," also deal with this critical period, and in particular with the transition to Christianity and the activities of missionaries. Of the latter, Mr. Harrisson is at one with Robert Louis Stevenson when he says: "With all their gross blots, with all their deficiency of candour, humour and common sense, the missionaries are the best and most useful whites in the Pacific."

Book IV covers the period 1863 to 1887, during which "blackbirding" began and flourished. Whole villages were barbarously herded together and transported to slave in the Australian sugar-cane and cotton fields. Side by side with those atrocities, pestilence, hitherto unknown, took its toll of the fast-declining population. Measles, whooping cough, diphtheria, influenza, scarlet fever, tuberculosis, and other foreign diseases reduced the New Hebrideans, whose numbers fell from an estimated 650,000 in 1870 to under 100,000 in 1892. Exploitation, kidnapping, massacre, and pestilence rendered the declining population easy victims to what is sometimes termed "the psychological factor in depopulation"—the almost invariably fatal apathy which is a primitive race's first reaction to the shock of contact with white people.

"Pandemonium Government" is the descriptive title of a humorous, if rather pathetic, commentary on the Franco-British Condominium. This is followed by an excellent treatise on the economic system of the New Hebrides and, later, by two or three striking studies on the "Yellow Peril" in the Pacific, where, says Mr. Harrisson, "Asia is waging a great war."

Of the Chinese and Japanese, who appear to be quietly and systematically gaining economic control in the islands, he says:

> "Living on a few pence, breeding like lemmings, dropping off steamers, discreet, polite, the only people in the New Hebrides who do not talk too much or get worked up over trivialities, the yellows make everything pay, get on with the natives, get their women, gain all along the line."

The author's final chapter, Book VII, brings the story down to 1933–1936, and it is here he discards the mantle of historian and again becomes the anthropologist. One learns, with some astonishment, that some of the older order survives. "There are still full-blooded cannibal heathens in the unvisited mountains—three thousand of them within ten miles of wireless station, hospital, Government posts and three sects of missionaries." The intimate knowledge Mr. Harrisson acquired led to his appointment as a Government Officer for the central islands with a special commission to bring that area under control.

Leave is taken of Mr. Harrisson aboard a copra-laden ship bound for Europe. His last recorded act is in defence of a peregrine falcon, at which a French fellow-passenger needlessly insists on shooting with a "shiny, monogrammed" revolver.

'Savage Civilization' is very well illustrated with reproduced photographs, text-figures, and maps. One of the photographs shows the author being initiated into Sakau manhood by a chief's wife, who cicatrizes a permanent pattern across his chest. The book contains also an excellent bibliography, which Mr. Har-

risson confesses having omitted to revise—an omission he regrets. Finally, there are sixteen pages of well-arranged index.

Not the least astonishing feature of this book is that, out of fragments of the past, the magnificent ancient sagas and chants, the author has pieced together, from memory, this hitherto untold story of the New Hebrides. On p. 387 he says: "I kept no diary and wrote no general notes." With the exception of some half-dozen pages, no part of the book was written in the islands. A remarkable achievement; but Mr. Harrisson is a remarkable man—his book is striking testimony to that fact. O. C. W. F.

BACK IN THE STONE AGE: The natives of Central Australia. By CHARLES CHEWINGS. *Sydney, Australia: Angus and Robertson* (*London: Australian Book Co.*), 1936 [1937]. 9×6½ *inches;* xviii+162 *pages; illustrations and map.* 7*s* 6*d*

This book can be read comfortably at one sitting. It is well set up, printed in clear type on good paper, contains 23 full-page plates, and is a brief, authoritative, and interesting narrative of the personal and tribal life of the Central Australian natives.

Dr. Chewings, who has had fifty years' acquaintance with the Australian aborigines, has compressed into a simply written story of 155 pages a description of the peculiar characteristics, beliefs and superstitions of these primitive people and of their stone tools and weapons. He discusses their hereditary traits; their rough and often brutally savage tribal justice; the settlement of differences among their women; marriage laws and customs; the result of the aboriginal's contact with whites and their present condition. Finally the author raises the question of their future and probable fate. Dr. Chewings expresses the opinion that, if one may judge from the rapid decrease in the numbers of Australian aborigines since the advent of white people into Australia, the race is destined to extinction not many generations hence. It is not without interest to find that scientists are devoting much attention to the Australian "black fellow"; studying their language and lore, measuring them, making plaster casts of their features and, by means of the cinematograph, taking permanent records of their daily life and occupations. Much valuable information has however been lost owing to whole tribes having already become extinct, but efforts are now being made to protect the remaining sixty thousand and to postpone, at all events, the entire disappearance of the race. One finds some difficulty in agreeing with Dr. Chewings' view that the scientist is "insatiable" and would keep the remaining natives as "zoological curiosities." O. C. W. F.

PHYSICAL AND BIOLOGICAL GEOGRAPHY

PALÄOGEOGRAPHIE UND TEKTONIK. By FRANZ KOSSMATT. *Berlin: Borntraeger,* 1936. 10×6½ *inches;* xxiv+414 *pages; illustrations and maps. M.*18.20

It is forty years since Professor Kossmatt published a paper on "The importance of the Cretaceous rocks of Southern India in estimating the geographical conditions during later Cretaceous times," which gave a world survey and synthesis of late Cretaceous formations. After a long interval, during which his name has not been familiar to bibliographers, he returns to the subject of palaeogeography in this comprehensive work. The first two-thirds of it are devoted to stratigraphy, treated particularly from the palaeogeographical point of view. As a reconstructor of past geographies Professor Kossmatt is cautious: the number of maps is only a fraction of those in the latest edition of de Lapparent, and they

are in general on too small a scale to invite the criticism of local geologists. We note however that the Antrim Cretaceous deposits are shown as belonging to an inlet of the Atlantic, not to an extension of the English chalk through the Cheshire Gap, as English geologists usually regard them.

The last third of the book deals with Tectonics. A general survey of the tectonic structure of all parts of the world is followed by a discussion of the various tectonic theories, and the relation of earth movements to marine transgressions, vulcanicity, ore-bodies, etc. A. M. D.

ECONOMIC AND HISTORICAL GEOGRAPHY

TURBULENT JOURNEY: A life of William Bligh, Vice-Admiral of the Blue. By OWEN RUTTER. *London: Ivor Nicholson and Watson*, 1936. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches; 280 pages; illustrations.* 18*s*

Mr. Rutter has in recent years contributed much to a true understanding of the mutiny on the *Bounty* by a careful examination of the relevant original documents. This has led him to consider the effect of the evidence upon the popular conception of Bligh's character, and this very interesting and well-written biography presents his conclusions concisely and with fairness. He does not conceal the direction of his sympathies, and the sole serious criticism of the book is that, though the evidence is presented impartially, it is converted by his comments into a sustained apologia for Bligh. The reader might have been left to draw his own conclusions.

From the first it is apparent that Bligh lacked the ability to work smoothly with his colleagues, and was given to suspect an underlying slight or ill-treatment in every trivial incident. His comments in his copy of the printed narrative of Cook's third voyage, written, as his biographer says, "in a spirit of acrimonious criticism," testify that this failing dated from his twenty-second year. Incidentally, Mr. Rutter points out, but is unable to solve satisfactorily, the problem of how Bligh, at this early age and without official connections, secured the appointment of Master on the *Discovery* for this voyage.

In 1787 Bligh was given the command of the *Bounty* for the "bread-fruit voyage" to Tahiti, largely on the recommendation of Sir Joseph Banks. The patronage of the latter stood Bligh well, for it later secured him the Governorship of New South Wales. It is impossible here to enter into the incidents of that voyage. Mr. Rutter argues that Bligh was no more severe than other naval officers of the period, and that, though Christian had cause to hate Bligh, the idea of mutiny would never have entered his head but for the whispered words of Stewart: "The people are ripe for anything." The course of the mutiny shows this to have been true, and suggests that there was deeper dissatisfaction with Bligh than Mr. Rutter is prepared to admit.

The mutiny suggests that Bligh was the wrong man for the particular conditions in which the *Bounty's* voyage was made: there can be no doubt that he was the wrong man to be Governor of New South Wales in the difficult situation which followed Philip King's retirement in 1805. Though the blame must be laid upon the military party for the mutiny of 1808, Bligh contributed to it by injudicious behaviour. Mr. Rutter goes at some length into the question of whether Bligh, when the mutineers were seeking him out, was found hiding under a bed. Since it is admitted that he was in hiding in an inner room, with the intention, quite properly, of escaping, the point as to whether he was actually under a bed appears of little importance.

Bligh was fated to be dogged by mutiny and courts-martial. Shortly before leaving for New South Wales he was put on trial for treating his officers "in a

tyrannical and oppressive and unofficerlike" manner. At the hearing it was part of Bligh's defence that it was customary with him "to use a great deal of action, with my hands, without having any particular meaning in it, but being merely a custom, without the least intention of insulting any one." Mr. Rutter suggests that this personal peculiarity had much to do with Bligh's troubles; in conjunction with his suspicious temperament it probably had. Bligh evidently tried to model himself upon Captain Cook: as a surveyor and navigator, he had the highest claim to respect; as a determined and stubborn fighter, he was without reproach on the grounds of personal bravery; and his conduct during the mutiny at the Nore redounds to his credit. His tragedy was the lack of a sufficient stability of character, which caused him to fall short of the high standard he had set himself. G. R. C.

GENERAL

GODS OF TO-MORROW: A journey in Asia and Australasia. By WILLIAM TEELING. *London: Lovat Dickson*, 1936. 8½×5½ *inches;* xii+376 *pages; illustrations and sketch-map.* 12*s* 6*d*

In 1934 Mr. William Teeling was invited to represent a patriotic society at the Melbourne Centenary Celebrations. The invitation gave him the opportunity to attain his long-cherished ambition of making a journey through Australasia and the Far East to study local conditions and to compare them with the conditions in the countries with which he was already familiar. His tour lasted nearly two years, and in the course of it he visited (besides Australia and New Zealand) Ceylon, Malaya, New Guinea, Fiji, China, the Philippines, and Japan.

He shows himself to be a serious and experienced traveller. He is a shrewd observer, with quickly-awakened sympathies and particular interest in sociological problems, eager to probe beneath superficialities, but with a mind sufficiently judicial to weigh and check his information. He has been at considerable pains to understand the problems which men and women who live in the far parts of the world are facing to-day. Bacon might well have found in Mr. Teeling the ideal traveller, for he observed whatsoever was memorable in the places he visited. He gives an impartial account of the Australians' tariff grievances, contrasts the conditions of the tea industry in Ceylon and Formosa, describes the ceremonial of kava drinking in Fiji, tells of Melanesians who prefer the Oxford Group to headhunting, discusses the seriousness of Japan's menace to the dependencies of other powers in the Far East, and much else besides. He is to be congratulated on having written a full and thoughtful book which is of definite value as a record of what people of varying nationalities and ideas are thinking in Australasia, the Pacific Islands, and Eastern Asia. O. R.

THE MONTHLY RECORD

FORESHORE EROSION ON THE NORTH SEA COASTS OF HOLLAND

An interesting account of the conditions of coast erosion on what the author calls the eastern shores of the North Sea is given in the *Royal Engineers Journal*, March 1937. It is a translation of an article by J. H. van der Burgt which appeared in *De Ingenieur*.

The author has spent his life on works of coast protection as an engineer on the staff of the Dutch State Waterways Administration. He introduces us to the historical background and the geological conditions of his native coasts and makes the vital struggle which the Dutch have always had to wage against the water real to those to whom sea soundings, tideways and underwater construction are familiar.

The need for scientific investigation and constant observation of all relevant factors is pressed and a description of what is being done by the Netherlands State Waterways Department follows. Fig. 5 is an ingenious chart showing the mean annual change in position of submarine contours and the average annual cost of works per kilometre. The defence works are classified as longitudinal (subdivided into seawalls and defended outer dunes) and groynes. The purpose and use of each is explained and the adaptation of typical constructions to different sites is discussed: the photographs of successful and unsuccessful construction, the text and the plates together fully describe the details.

The Dutch coast is all sand, without rock or shingle. The favoured type of defence against erosion consists of a seawall parallel to the high-water line, supported by groynes, at right angles to it, at intervals which can only be determined in the last resort by trial. The groynes are comparatively wide, low, masonry-covered structures which extend from the foot of the dune or the seawall at about high-water mark to just below low-water ordinary spring tides. The proved cross-section for a seawall (without a dune behind) extends from well below the lowest tide to above the furthest sweep of the biggest waves on an exceptionally high tide. The toe of the surface covering, beginning in the underwater sand, is steep and convex to the sea as it rises; somewhere about the high-water level the surface proceeds at a gentle upward gradient upon which all ordinary waves run up till they are spent: above this, where as a rule the slope is steeper again, the worst gales on the highest tides spend themselves without running over on to the low ground behind. The best masonry covering, and this is not uncommonly met with, is basalt set dry. It is very costly, but is everlasting and only very rarely gets dislodged by the waves.

The text is illustrated by twelve photographs and eleven plates (bound in an Appendix). The printing of the views leaves something to be desired, which is a pity when the detail is really important to the illustration of the subject-matter. Fig. 1 presents us with a vivid impression of the immense difficulties, successfully overcome, which ever since the sixteenth century the Dutch engineers have had to face in stemming the fierce erosion at the Helder and preventing the inundation of the low-lying polder behind. We are not told whether the erosion at this point has much decreased with the damming of the Zuider, as might be supposed, but it is perhaps too soon after the event to be sure. The local situation here and of all the coast protection works from Dunkirk to Emden is made clear in Figs. 2, 3, 4, which at scales from 1/2,500,000 to 1/300,000 give details of the type of coast, the underwater contours, and the

defended portions of the shore. The smallest scale includes most of the North Sea from the Straits of Dover to Skagerrak.

Fig. 9 shows graphs of annual expenditures on works, and is followed by large-scale cross-sections of the Dutch seawalls in different places (1/500) and of some in France, Belgium, and Germany at 1/1,250. Two plates of groyne cross-sections (at scales between 1/100 and 1/1000) in all the four countries follow. The last plate gives a complete account in graphic form of the formation of a wind-blown drift-dyke of sand, a type of sea defence so much in evidence in the dune lands of Holland. There are also some sketches (Fig. 25, not to scale) which explain how the Dutch construct and sink into position the wattle-work mattresses with which the sand below low water so often has to be protected.

The Editor is much to be congratulated on a translation of technical matter and of all the technical terms and signs on the maps and plans which is really satisfactory to the engineer; also on having reproduced the plans on scales large enough to make any further demands on the author for other detail unnecessary. There follows a short bibliography upon which the subject-matter for France, Belgium, and Germany was no doubt partly based. Copies of this article, with plates and illustrations, may be obtained from the Editor, *R. E. J.*

THE PORT OF NAPLES

The Italian National Committee for Geography have begun the publication of a series of monographs upon the ports of Italy. The first, by Professor Ferdinando Milone, who is general editor of the series, deals with Naples. The aim is, in addition to describing briefly the history of the port and analyzing the present characteristics of its traffic, to determine the most profitable lines of future development. Until 1914, the chief function of Naples was a port for the transport of emigrants overseas, particularly to North America. At the beginning of the century, eighty-five per cent. of all travellers to or from that continent through Italian ports passed through Naples. This percentage had decreased to seventy by 1913, due more to the growth of emigration direct from Sicily than to competition from Genoa. The changed political conditions after the war affected this traffic considerably: in 1925 the number of emigrants leaving Naples for the United States was scarcely one-tenth of the figure for 1913. This has been compensated to some extent by increased migration to Mediterranean countries and through the Suez Canal. In other directions, Naples has been handicapped in competition with other Italian ports. Commercially, its function is largely regional. There is little transhipment or re-export of goods for the countries of continental Europe, owing to its relative isolation, and the region which it serves is almost entirely agricultural, and largely undeveloped. Its imports are thus limited to the coal, cereals, and oil required by its immediate region; its exports to agricultural products prepared for sale abroad. It also serves as a coaling station, and the combination of this with the above factors makes it difficult for vessels to obtain return cargoes. The author is not pessimistic about its future development: in addition to a revival of passenger traffic, he looks forward to the development of communications and industries, specially fostered, in Southern Italy, and to expanding overseas trade.

The book has a number of small illustrations and diagrams of a very simple type, which add little to the statistics given in the text. The latter are often expressed as percentages of a total figure not always easy to ascertain, and it would have been convenient to have grouped them in an appendix. There is a plan of the port, but a sketch-map showing the communications of Southern Italy would have been useful.

THE *CALCUTTA GEOGRAPHICAL REVIEW*

We have received the first number of the *Calcutta Geographical Review* which appeared in September 1936. The Calcutta Geographical Society was inaugurated in July 1933 in order to supply a central organization for the increase and spread of geographical culture in Bengal, and thereby to contribute towards the progress of geographical knowledge in India. The *Review* opens with messages from the Governor of Bengal and the Vice-Chancellor of Calcutta University. There are seven articles on topics as varied as Tibet, the teaching of geography in India, glimpses of Burma, and impressions of Japan. Short summaries are provided of four lectures delivered before the Society, and there are three abstracts from other geographical journals. The *Review* closes with the Annual Reports on the work of the Society 1933–35. We take this opportunity of wishing the Calcutta Geographical Society success in their venture.

RAINFALL ALONG THE CHINESE COAST

In an article by John Lee on "Precipitation on the Islands along the Chinese Coast," published in the *Monthly Weather Review* for September 1936, it is pointed out that, though the mean annual rainfall is in general much more abundant near the sea than in the interior of China, towards the very margin of the sea coast it decreases again. This decrease is especially marked on the islands along the shore. It is explained that as the islands are mostly flat and relatively cool and windy in summer, the wet season, the moist air of the south-east monsoon tends to pass over them without rising in powerful convection currents as happens farther inland where thunderstorms are frequent. Tables comparing pairs of coastal and island stations indicate a mean annual precipitation about 10 inches higher on the average on the mainland, but the difference amounts to 23 inches in the case of the pair Pagoda Anchorage and Tung Yung island. In the subtropical belt however the islands are wetter than the mainland except during summer, when the deficiency is great enough to make the total annual quantity smaller.

This paper usefully draws attention to the distribution of rainfall within a narrow belt on the coast of China and exposes the rather common fallacy that rainfall is necessarily closely related to distance from the sea. But unfortunately the author introduces his discussion with a decided misapplication of a climatological principle. When contrasting seasonal rainfall at Peking, showing the summer maximum characteristic of a continental climate, with that at Madrid in the same latitude, showing the summer minimum of a marine climate, the argument would have been far more effectively illustrated had Lisbon, which is near the latitude in question and possesses a marine climate, been chosen. Madrid has in no sense a marine climate, and the summer dryness of the Iberian peninsula, as of the Mediterranean in general, has nothing to do with oceanity of climate in itself, being due to the expansion of the Atlantic sub-tropical high-pressure system. It is not possible to interpret seasonal rainfalls simply in terms of climatic continentality or oceanity. England is far more oceanic in climate than Spain, yet parts of it are sufficiently continental for a slight summer rainfall.

HYDROLOGY OF ETHIOPIA

In a publication of the Italian Ministry of Public Works (Rome, 1936) entitled 'Notizie idrografiche sull' Africa Orientiale Italiana,' Professor Marco Visentini brings together much useful information concerning the hydrology of Ethiopia and contiguous territories. The compilation is based upon all available material,

which, to judge by a list of over a hundred bibliographical entries, is large. There is a general description of the morphology, geology, meteorology, and vulcanology of the region followed by a detailed account of the various hydrographic basins. A good deal of the information is given in diagrammatic form and in a number of statistical tables and appendices.

A handsome feature of this memoir are four maps in colour, three on the scale of 1:10,000,000, showing respectively volcanic manifestations, mean annual, rainfall, and mean annual temperature, and a fourth on the scale of 1:3,000,000, defining in colour the areas of eleven separate river basins in which the course of the numerous distributories is clearly delineated. On the rainfall map the wettest region is a small area about 300 kilometres south-west of Lake Tana with over 1800 mm. (72 inches). The temperature map shows a large lofty area south-east of that lake as cool as 16° C. (60° F.). The temperature data on which this map is based, though stated to be not very abundant, are considered sufficient in relation to questions of run-off. The isotherms have evidently not been reduced to sea-level, so that it may be presumed that the Abyssinian tableland is sufficiently regular to make an attempt to show the general trend of the actual isotherms possible. The volcanic map indicates the positions of active volcanoes, fumaroles, hot springs, and chemical deposits.

RECESSION OF KILIMANJARO ICE-CAP

In *Tanganyika Notes and Records* for October 1936 Mr. W. Geilinger gives an account of the "Retreat of the Kilimanjaro Glaciers," based on observations which he made during a stay of many months on Kilimanjaro as well as during repeated ascents in a period of six years. His notes, which are intended to continue Professor Fritz Jaeger's summary of Kilimanjaro's glacial history, show the considerable changes, illustrated by a number of excellent photographs, that the Kibo glaciers have undergone within the recent past. Kibo, 5965 metres above sea-level, is the only one of Kilimanjaro's extinct volcanoes to bear an ice-cap. The oblique position of this ice-cap, which on the north-east side only reaches slightly below the edge of the crater, but on the south-west side extends as far down as 4550 metres, is due to meteorological causes. The north-east side of the mountain receives most of its precipitation during the "small rains" brought between November and February by the North-East monsoon, whereas the south-west side is affected by the "big rains" of the South-East trade between March and September. The latter rains reach a maximum in April and May, and by a local deflection of the South-East trade into a south-westerly wind fall heavily on the western flanks of Kibo. In consequence however of the fact that the highest levels of the mountain lie between May and October, under the persistent influence of the dry North-East anti-trade comparatively little of the moisture brought by the South-East trade is precipitated above the altitude of 4000 metres. Hence the crater, though getting all its precipitation in the form of snow, only receives a light snowfall under the meteorological regimen prevailing at the present time. Apparently this dry regimen has persisted for a long time, for the ice-cap has been diminishing steadily ever since observations were commenced by H. Meyer in 1887.

The Kibo crater, though in the tropics, is high enough to constitute an ideal reservoir of snow and ice for which the Baranco glaciers would provide a suitable outlet. Actually however the crater is a pronounced area of ablation which is not of recent date, but has evidently been intensified within the most recent past. The glaciers within the crater are, in fact, shrinking at a greater rate than those on the outer slopes. This anomaly is attributed to the dry north-east wind which, by acting as a barrier to the ingress of clouds and moisture from the

south-west, allows the tropical sun to shine vertically with full force on the flat surface of the crater. The author thinks it likely that, if the climatic conditions of the last half-century continue, the ice within the crater may disappear entirely in decades to come, as also, at a later date, that on the outer slopes.

MEETINGS: SESSION 1936–37

Eighth Evening Meeting, 22 February 1937. Dr. T. G. Longstaff, Vice-President, in the Chair

Elections: Miss Marian Lisbeth Atkins; Miss Mary Best; Captain William H. Bevan; William Blackwell; Frank Buck; Wing-Commander F. H. Coleman, D.S.O., R.A.F.; Samson Frederick Cotton, B.A.; Bertram Henry Cudmore, B.A.; Cedric Deller; Joseph Peter de Verteuil; Archie James Dilloway; Miss Fedelma N. Donnelly; Lieut.-Commander Bernard William Galpin, R.N. (retd.); Joseph Arthur Lee; Captain John Keith Nethercoate; David Paterson; Harold Schofield; Alan Thomas Comben Slee, B.SC.; Mrs. Eleanor Florence Llewellyn Pettigrew-Smith; Miss Sara Sprowle; John Stainer; His Honour Douglas Roy Stewart, C.M.G.; Miss Bertha Rivers-Thompson; Harry Town; Mrs. Clarice Warner; Miss Evelyn Jeanie Wheen

Paper: More Explorations round Nanda Devi. By Mr. Eric Shipton

Ninth Evening Meeting, 8 March 1937. Colonel Sir Charles Close, Vice-President, in the Chair

Elections: George Elliott Ballam; George Bell Brand; Adrian Buxton; Mrs. Edith M. Clark; Lieut.-Commander George Hugh Darby, R.N.; Thomas Dunbabin; Richard Harold Greenwood, B.A.; Francis Lionel Hudson; Professor Diwan Bahadur Hiralal Lallubhai Kaji, M.A., B.SC., J.P.; John Spedan Lewis; Michael Hildesley Lycett Lycett; Hayes Perkins; F. F. Prickett; Subimal Chandra Roy, B.A., LL.B.; Rev. Irvin W. Underhill, Jnr.; Captain Walter Clarence Van Eeden

Paper: The Tennessee Valley Project. By Mr. George Barbour

Sixth Afternoon Meeting, 15 March 1937. Sir John Chancellor, Vice-President, in the Chair

Paper: A Study of Settlement in the Cross River Area, Southern Nigeria. By Professor C. Daryll Forde

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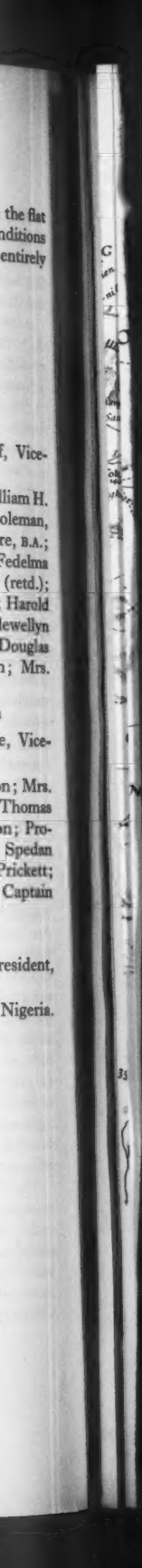

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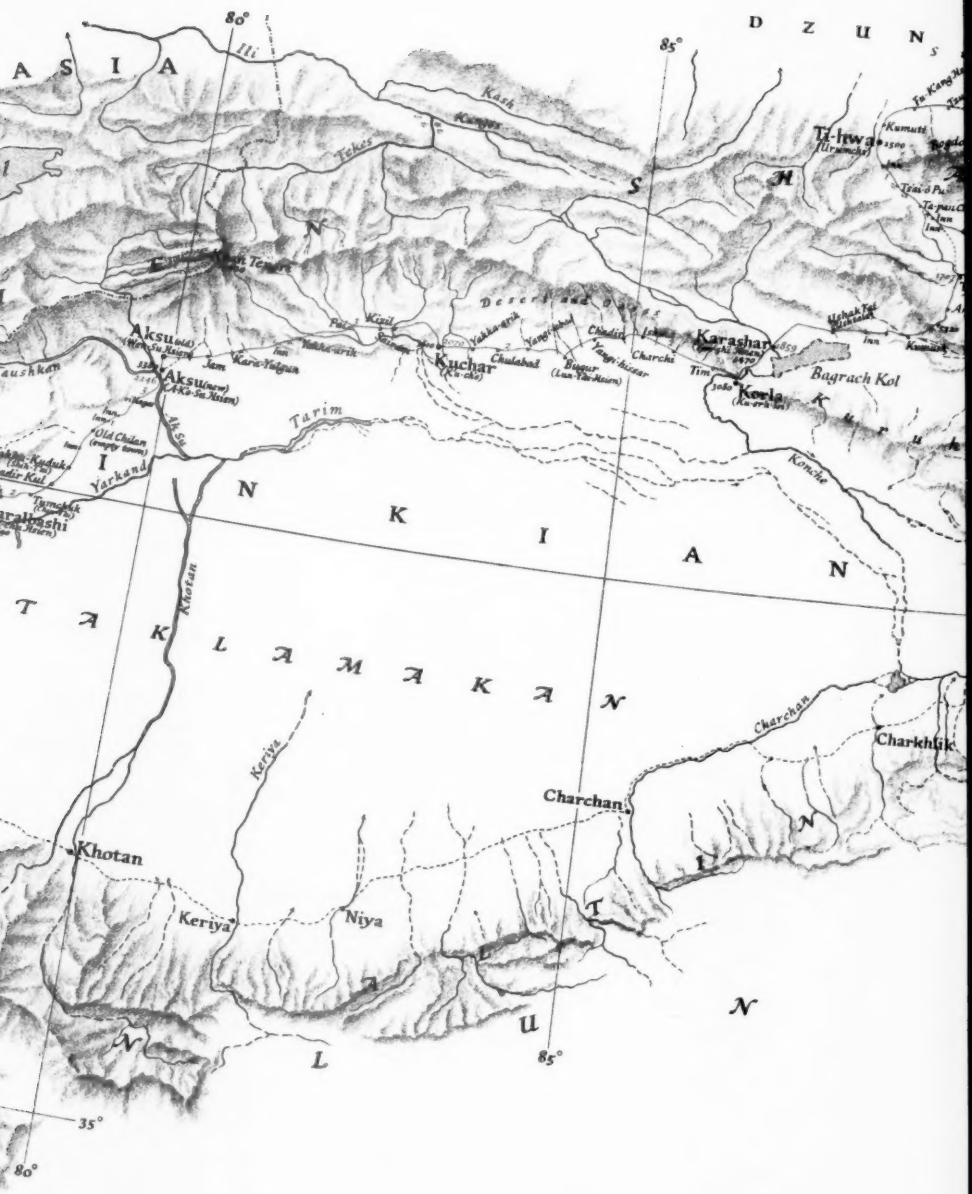
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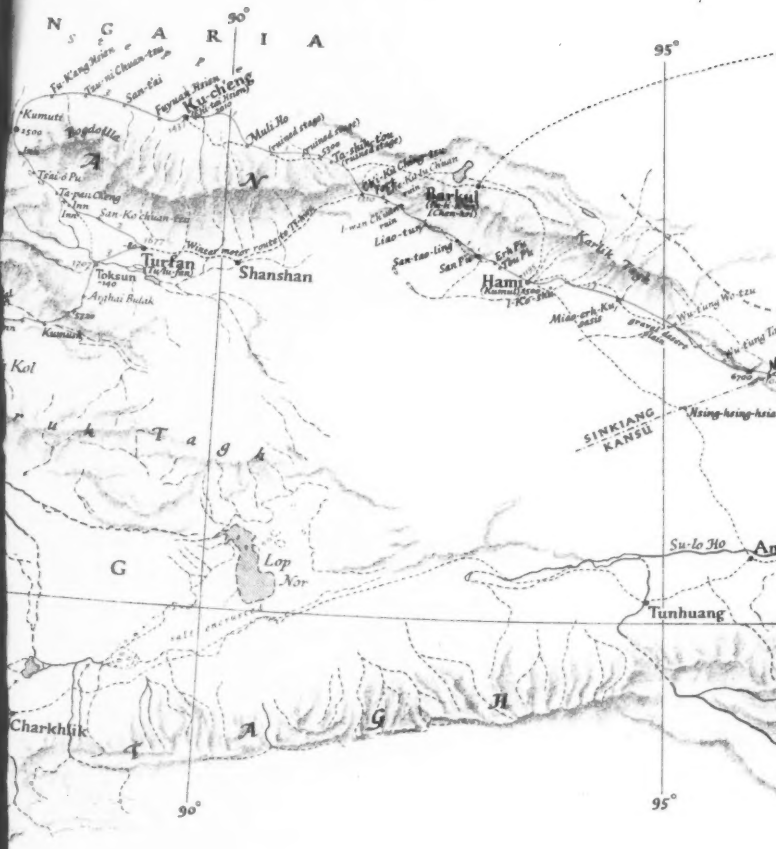

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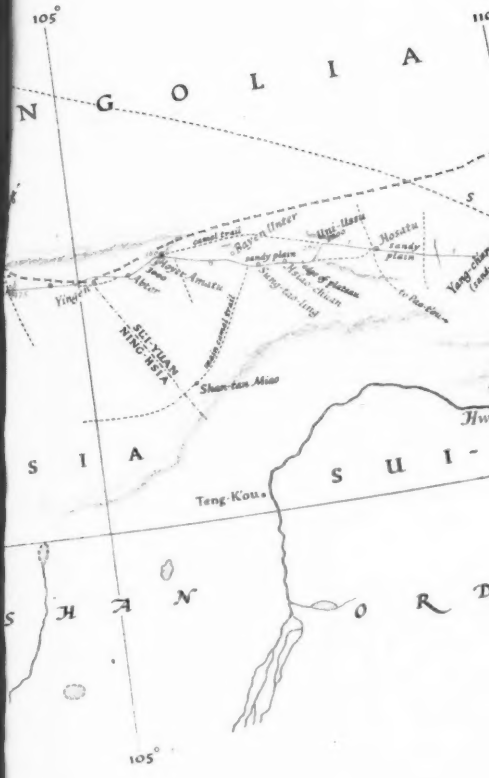

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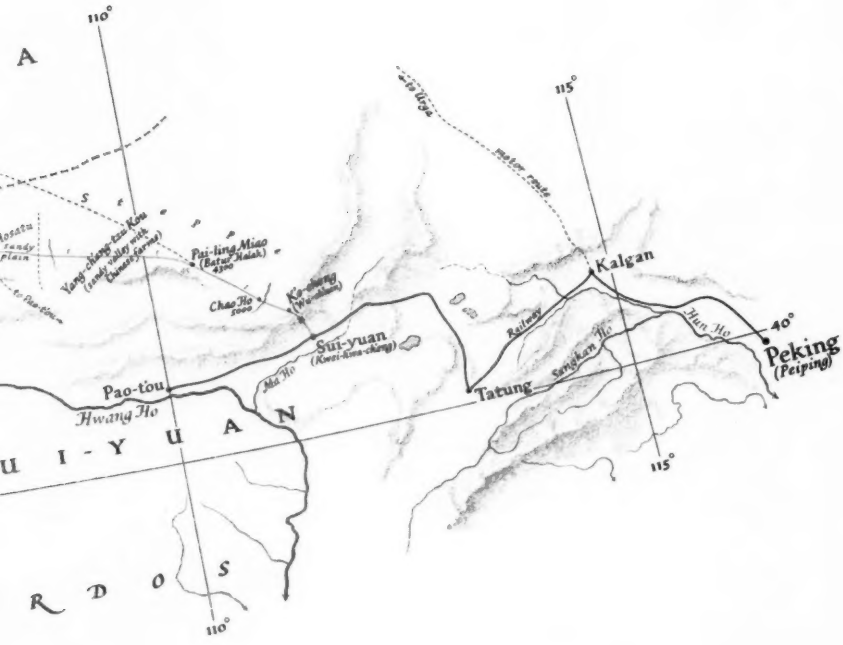

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